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Three Essays on the Household: Time, Money, and Future Time and Money

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Three Essays on the Household: Time, Money, and Future Time and Money

by

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Three Essays on the Household: Time, Money, and Future Time and Money

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How do time constraints affect household expenditures? How productive are household time expenditures, and how do spouses jointly make decisions over time activities?

In this thesis I present three essays on the family, time, and household decision making. In the first essay, I ask: What is the time and goods cost of child? Understanding the substitution between time and market goods is increasingly important as incomes increase and available time does not. In this study, I estimate household demands for time and market goods used in

caring for children. To construct a data set with time and market goods, I map information from the American Time Use Survey and the Current Population Survey into the Consumer Expenditure Interview Survey for single women and single women with one or two children. I also construct inter-area price indexes to obtain sufficient price variation for estimation. With these price measures and proxies for the value of single parents' time, I estimate household commodity input demands and the cost of a child, holding utility constant. I also report price, cross-price, and income elasticities for time and goods inputs into child care.

In the second essay, I ask: What is the return to volunteering? A household's choice to donate time depends on the productivity of volunteering, yet measuring the productivity of volunteering is elusive because the productivity of volunteers is difficult to quantify. I use differences in students' test scores as a proxy for the productivity of classroom parent volunteers. After correcting for biases due to the endogeneity of volunteers, I find that volunteers increase their child's first grade reading test scores by 12 percent. In addition, teachers assign volunteer parents' children higher grades than non-volunteer parents' children.

The final essay attempts to understand how couples make decisions. This is a joint work with my colleague, Jungmin Lee. Using individual bank account data from South Korea, where joint accounts are rare and the legal system emphasizes the individuality of financial transactions, we examine the distribution of financial resources between spouses within households. We find that each member's share of household savings depends on the balance of bargaining power. We also find that an increase in a wife's bargaining power increases total household savings. These findings deviate from the traditional

unitary model of the household.

Contents

Chapter 1

Introduction

As far back as societies of hunters and gatherers, families and household production have been the source of economic success or failure. It is ironic that the first forms of household production were very time intensive, yet for the past century economists have focused on the goods allocation and goods consumption of households instead of the time allocation and the time consumption of households. In the following three chapters I present research on the behavior of families. In the first chapter, I consider the time and goods cost of children, in the second, the effectiveness of volunteering in a child's classroom, and in the third, the process through which families make decisions.

For decades, economists have estimated the market goods cost of children; however, the largest cost of raising children is not in terms of dollars, but in terms of hours. In this essay, I ask, What is the time and market goods cost of children? I also characterize how households substitute time for market goods. Understanding substitution between time and market goods is becoming increasingly important as incomes increase but available time does not. I estimate household demands for time and market goods with the Linear Ex-

penditure System. To construct a data set with time and market goods, I map information from the American Time Use Survey and the Current Population Survey into the Consumer Expenditure Interview Survey for single women and single women with children. To obtain sufficient price variant, I construct inter-area price indexes. With these price measures and proxies for the value of single parents' time, I estimate household production input demands and the cost of children via equivalence scales. I also report price, cross-price, and income elasticities for time and goods household inputs.

In the second essay, I ask: What is the return to volunteering? A household's choice to donate time depends on the productivity of volunteering, yet measuring the productivity of volunteering is elusive because the productivity of volunteers is difficult to quantify. I use differences in students' test scores as a proxy for the productivity of classroom parent volunteers. After correcting for biases due to the endogeneity of volunteers, I find that volunteers increase their child's first grade reading test scores by 12 percent. In addition, teachers assign volunteer parents' children higher grades than non-volunteer parents' children.

The final essay covers the difficult task of understanding how spouses make decisions where each may exert "pressure" to obtain their desired outcome. In this paper with Jungmin Lee, a fellow graduate student at the time, we ask, Do differences in individual bank account holdings affect how much households decide to save? Using individual bank account data from South Korea, where joint accounts are rare and the legal system emphasizes the individuality of financial transactions, we examine the distribution of financial resources between spouses within households. We find that each member's share of household savings depends on bargaining power. We also find that an

increase in a wife's bargaining power increases total household savings. These findings deviate from the traditional unitary model of the household.

Chapter 2

Time and Goods Cost of Children

2.1 Introduction

What is the cost of a child, including both time and good expenditures? Since the advent of the field of economics, economists have been concerned about the welfare of households. Among households with the greatest needs and concerns of society are those with children. And among households with children, those often in the most perilous of economic circumstances are single parent households. Most of our understanding of the costs of children are with regards to goods expenditures. However, for parents, in particular single parents, the greatest cost of raising a child is time costs. To understand the full costs of children, I estimate the time and goods expenditure cost of a child.

The theory of including time in household demands begins with Becker (1965). Since Becker's work, many others have stressed that in order for house-

holds to consume market goods, or raise children, they must also consume time (Pollak and Wachter, 1975; Kooreman and Kapteyn, 1987; Montmarquette and Monty, 1987; Robinson, 1987; Juster and Stafford, 1991; Gustafsson and Kjulin, 1994; Apps and Rees, 2001; Hamermesh and Lee, 2007). For some commodities, such as general health, the absence of information about time is less deleterious to a household demand system than for commodities that are more time intensive, such as relaxing and child care (Gronau and Hamermesh, 2006). Because a large cost of raising children is time, estimates of the cost of children based only on market goods are grossly underestimated.

In addition to including time in calculating the cost of children, I also include price variation for time and market goods. Comparable prices across regions are generally not available to researchers. Though the Bureau of Labor Statistics (BLS) reports price indices for various goods and regions that are comparable across time within a region, these indices are not comparable across regions. With a BLS report that constructs region comparable price indices for the period July 1988 to June 1989 (Kokoski, Cardiff, and Moulton, 1994), I create price indices that are comparable across regions.

These two novelties, the inclusion of time and regional price variation, identify additional variations in household welfare. Estimates of the cost of a child based on these innovations are more accurate than previous estimates and allow policy makers to customize welfare policies according to differences in household time constraints and prices.

I find that the time and goods cost of a child is about 90 percent of the time and goods cost of a single mother reference household. I find that the quarterly time and market goods cost of a child is \$16,044 for a single mother whose quarterly time and goods cost is \$17,546. I also separately estimate

the time and the goods cost of a child. As reported in other studies, I find that the goods cost of a child is about 20 percent of the goods cost of a single mother. These results suggest the importance of parental visits and including time costs in alimony payments and welfare planning. In short, the goods cost of raising a child pale in comparison to the time costs.

In the next section, I discuss a theory of household demands over time and goods. Following Section 2.2, I explain the estimation strategy in Section 2.3 and the data sets in Section 2.4. The results are in Section 2.5 followed by concluding thoughts and remarks in Section 2.6.

2.2 Theory

Becker's (1965) theory of the allocation of time suggests that households use time and market goods to produce household commodities that are jointly consumed by households. The distinction is that households do not consume food and food preparation time separately, but that they consume what these two inputs produce together—a meal.

Accompanying the production of a commodity is the implicit price of that commodity. Pollak and Wachter (1975) note that in order to apply results from demand theory to household production, commodity prices must be independent of preferences and the household production technology that generates the commodities. One case where commodity prices are independent of preferences and technology is a household that produces commodities with a constant returns to scale technology and exhibits no joint production. With these assumptions, and a measure of the commodities produced by the household, commodity demands can be estimated and implicit prices can be

calculated.[1]

Pollak and Wachter (1975) suggest two formulations for household utility with time goods. The first follows Becker's paradigm that households consume commodities which are produced through a household production function. The other approach is that households have preferences over input demands. Though not as theoretically clean as the first, this formulation does bypass rather strong assumptions that must be placed on the production function in order to separate preferences and technology from entering commodity prices. For both theoretical frameworks, the demand system below represents the demand for time and goods inputs.

2.2.1 Household Activities

The study of the allocation of time and market goods rather than the demand for time and goods relaxes the requirement of commodity measures and constraints on the household production technology (see Pollak and Wachter, 1975, Section 5.b). Suppose there exists a mapping from $U(\mathbf{z})$, a household's utility function over household commodities, and $W(\mathbf{y}, \mathbf{t})$, a household's utility function over time and market goods. This assumption, in essence, suppresses the household production function into the household utility function. Instead of a utility function over commodities, there is a utility function over activities where an activity is a pair-wise combination of time and goods. For-

[1] Measures of household commodity production, however, are not readily available. For instance, information on the number of meals that a household produces is not commonly found in expenditure data sets. Even if this type of information were available, the quality of one meal may differ from the quality of another meal. One possible measure of household commodities are quality-quantity indices, such as health, education, and well-being indices. Demands and implicit prices for these goods are some household commodities that could be readily estimated with existing data sets.

mally, the household solves

$$\max W(\mathbf{y}, \mathbf{t}) \tag{2.1}$$

such that

$$\sum_{s=1}^{l} \sum_{k=1}^{n} p_k y_{sk} + w \sum_{s=1}^{l} t_s \leq I + wT \tag{2.2}$$

where y and t are market goods and time inputs, respectively, p is the price of a market good, w is the market wage, I is non-market income, T is total time available, s indexes activities, and k indexes market goods. In this framework, time enters the utility function like a market good and the household problem is a generalization of a typical labor-leisure problem. Note that this expression of the budget constraint allows for multiple market goods to be combined with time for an activity, but that multiple uses of time for a unique activity is not allowed. The existence of these demand functions depends on the ability to distinguish the use of good k in activity s from its other uses and being able to partition activities in the day.

In the model presented above, the price of time for all time activities is the opportunity cost or the forgone wage. This assumes that the household could work any amount of additional hours, which is far from an innocuous assumption (Hamermesh, 1998). For example, the opportunity cost of reading a book late Friday night because you cannot sleep is not your hourly wage; it is less. Assuming a constant wage over-estimates the total value of all time activities.[2]

[2] A valuation methodology for the price time is to assign the price that one would pay to purchase the same activity in the market. For example, the price of cleaning a home is the cost to hire someone to clean the home. This valuation of time, on the other hand, does not consider the utility derived from time activities.

Kimmel and Connelly (2006) consider a similar problem: Is a mother's time with her child labor or leisure?

A constant price provides little information for why choices are made among different time activities. All explanatory power for why certain time activities are chosen over others is then generated from differences in goods prices and preferences, not from differences in time prices. The practical problem with a constant value of time is that without variation in the price of time, time activity demands cannot be estimated in a typical demand system framework.[3]

To allow for the value of time to vary, I consider the constraint:

$$p_f f + p_h h + p_o o + +wl + w_c c + p_s s = I + wh + wl + w_c c, \qquad (2.3)$$

where f, h, o, l, c, and s denote food, housing, all other goods expenditures, leisure, child care, and savings (or dis-savings if $s < 0$), respectively. The hourly wage is w and the price of child care is the market wage for child care services, w_c.[4] This constraint does not follow from equation 2.2 and sidesteps the important issue of how time activities enter the budget constraint. However, it does allow for the choice of leisure and child care time activities to be determined by differences in prices, and it allows these five goods: food, housing, other, leisure, and child care, to be estimated in a typical demand system framework.[5]

[3]For an analysis of child care time using a constant value of time, see Bradbury (2005).

[4]Think of households as being both suppliers and demanders of child care services.

[5]What is missing from the theoretical model that would allow typical demand systems and prices to determine time activity choices are differences in productivity. For example, the first hour of collapsing on the sofa and watching TV after working a 10 hour shift of framing a construction home does not substitute for the first hour of work at the construction site.

The constraint in equation 2.3 can also be written as

$$\begin{aligned} p_f f + p_h h + p_o o + + wl + w_c c &= (I - p_s s) + wh + wl + w_c c \qquad (2.4) \\ &= A + wh + wl + w_c c \\ &= A + w\,(T - c) + w_c c. \end{aligned}$$

The right-hand side represents full income and the left-hand side represents full expenditures.[6] The inclusion of $w_c c$ on the right and left-hand side of the budget constraint represents the idea that child care is just like a second job, one that is both supplied (the right-hand side) and demanded by the household (left-hand side). An alternative is to exclude child care time from the total time available, T. This, however, removes child care from the set of consumption goods, whereas the constraint written as above allows the choice of the amount of child care to be influenced by preferences.

As Thompson (2004) and others note, full expenditure is not exogenous. Thompson suggests including an additional equation in the demand system with total expenditures as the dependent variable and income, overall prices, and macro economic indicators as other determinates. He also notes that traditional elasticities are also not correct because as prices change full expenditure also changes. With expenditures defined as above, as a function of the wage, this observation is all the more consequential.

[6] I use the term full income and full expenditure to denote incomes and expenditures that account for the value of time.

2.3 Estimation Strategy

I use the Linear Expenditure System (LES) to estimate household demands. The LES is restrictive, but it is also econometrically straightforward to obtain estimates for a large and complex demand system. The LES indirect utility function is

$$V(p,m) = \frac{m - \sum p_k b_k}{\prod p_k^{a_k}} \tag{2.5}$$

where m is full income, p_k is the price for good k, and a_k and b_k are parameters to be estimated. Applying Roy's identity yields the Marshallian demand for good i:

$$x_i = b_i - \frac{a_i}{p_i}\sum p_k b_k + \frac{a_i}{p_i} m. \tag{2.6}$$

The expenditure share form is

$$\begin{aligned} \omega_i \equiv \frac{p_i x_i}{m} &= \frac{b_i p_i}{m} - \frac{a_i}{m}\sum p_k b_k + a_i \\ &= \frac{b_i p_i}{m} + a_i\left(1 - \frac{\sum p_k b_k}{m}\right). \end{aligned} \tag{2.7}$$

The cost function is the inverse of the indirect utility function:

$$m = u\prod p_k^{a_k} + \sum p_k b_k \tag{2.8}$$

for a given level of level, u.

One way to include demographic characteristics is through translation (Pollak and Wales, 1978, 1981). The original demand system for good i, $x_i = \bar{h}^i(p,m)$, is replaced with, $h^i(p,m) = g_i + \bar{h}_i(p, m - \sum p_k g_k)$. Similarly, the indirect utility function, $\bar{V}(p,m)$, is replaced with $V(p,m) = \bar{V}(p, m - \sum p_k g_k)$. Demographic variation enters the demand system through

g_i. If g_i equals the number of persons in the household, this specification allows the effect of g_i to vary by each commodity. By extension, g_i may be a vector of demographics. In the case of two goods and three demographics, g_1, g_2, and g_3, the demand share equation would be

$$\omega_1 = \frac{p_1\left(b_1^* + \delta_{11}d_1 + \delta_{12}d_2 + \delta_{13}d_3\right)}{m} + a_1\left(1 - \frac{p_1\left(b_1^* + \delta_{11}d_1 + \delta_{12}d_2 + \delta_{13}d_3\right) + p_2\left(b_2^* + \delta_{21}d_1 + \delta_{22}d_2 + \delta_{23}d_3\right)}{m}\right) \tag{2.9}$$

$$\omega_2 = \frac{p_2\left(b_2^* + \delta_{21}d_1 + \delta_{22}d_2 + \delta_{23}d_3\right)}{m} + a_2\left(1 - \frac{p_1\left(b_1^* + \delta_{11}d_1 + \delta_{12}d_2 + \delta_{13}d_3\right) + p_2\left(b_2^* + \delta_{21}d_1 + \delta_{22}d_2 + \delta_{23}d_3\right)}{m}\right) \tag{2.10}$$

where $g_1 = \delta_{i1}d_1$, $g_2 = \delta_{i2}d_2$, and $g_3 = \delta_{i3}d_3$.

Each additional demographic variable increases the number of parameters to be estimated by the number of goods in the demand system. I experiment with three child age groups for all possible combinations of zero to two children.[7] This adds $9 * I$ parameters to be estimated, where I is the number of demands. Reasonable parameter estimates are difficult to obtain in such a large parameter space. To restrict the number of parameters, I assume that the demographic parameters are constant across share demand equations. Though this restricts the variation by goods across family compositions, it allows greater flexibility for economies of scale.

An alternative is to reduce the number of demographic variables by

[7] There are 9 combinations. For example, one young child, one middle child, one older child, two young children, one young child and one middle child, one young child and one older child, etc.

only using three demographic variables, where each variable represents the number of children in each of the three age groups. However, note that using a dummy variable for each family composition type adds more flexibility. With three age groups, young, middle, and old, each group may have zero, one, or two children. With this specification, and with more than one child in the household, economies of scale are constant within each age group. That is, an additional child in any age group requires the same amount as the first child in that age group. For goods, this maybe permissible; but for time – especially for child care time activities – this is entirely unreasonable.

I consider demand systems separately for goods, time, and time and goods. The former two systems, goods and time, are mis-specifications of the true model, since neither can be consumed without the other.[8]

The share demand equation that I estimate is

$$\omega_i = \frac{p_i}{m} b_i + a_i \left(1 - \frac{1}{m} \sum p_k b_k \right) + \varepsilon_i \tag{2.11}$$

where i denotes either goods, time, or time and goods, and $b_i = b_i^* + \boldsymbol{\delta}\mathbf{d}$. I allow the error terms, ε_i, to be correlated across share demand equations by employing Zellner's Seeming Unrelated Regression methodology (Zellner, 1962; Zellner and Huang, 1962; Zellner, 1963). For each of these systems, I use the estimated parameters to calculate the indirect utility and the cost function for the reference household, a single mother. With the reference household utility, I use the demographic variables to calculate the cost function for each

[8]For more on the joint consumption of goods and time see Becker (1965).

household type. These calculations lead to the equivalence scales

$$E_j^r = \frac{c^r\left(\mathbf{p}^r, u^r, d_j\right)}{c^r\left(\mathbf{p}^r, u^r, 0\right)} \tag{2.12}$$

where $c^r\left(.,.,.\right)$ is the LES expenditure function, price and utility are at the reference household levels, and d_j represents the demographic translating effect of the jth household composition on the reference household's expenditure.

2.4 Data

To measure the time and market good cost of a child, I use the 2003 and 2004 American Time Surveys (ATUS), the 2003 Consumer Expenditure Interview Survey (CEX), and various years of the Consumer Price Index (CPI). I partition time use into four categories: work, sleep, child care, and leisure, and impute these categories into the CEX from the ATUS. Since the ATUS contains time information on only one individual in the household, I consider only single-headed households in both the ATUS and the CEX. As a price of an individual's time, I impute a wage rate based on the 2003 and 2004 Current Population Surveys (CPS). To compute the price of household child care, I impute the wage rate of the individual as if they were in the child care industry. To construct price indices that have variation across areas, I construct area comparable price indices with the CPI and a report by the BLS with detailed information on prices levels (Kokoski, Cardiff, and Moulton, 1994). I describe these data sets below.

2.4.1 American Time Use Survey

The ATUS began in 2003 and will continue indefinitely under the direction of the BLS.[9] The 2003 ATUS included 20,720 households and the 2004 survey included about half that number households, 13,973. Respondents in the ATUS were sampled from groups rotating out of the CPS. One individual over the age of 15 of the selected outgoing household completed a time diary for a day of the week beginning at 4 AM and ending at 4 AM the next day. The sampling scheme over-sampled weekends: 25 percent of the time diaries cover each weekend day, and 10 percent of the diaries account for each weekday day.[10] In addition to recording time use activities in one of 441 categories, respondents also recorded where the activity occurred and who was present during the activity.[11] The BLS also collected information on secondary activities if the secondary activity was child care.

Like the ATUS, goods expenditure data in the CEX are collected from one person in the consumer unit, but cover the entire consumer unit.[12] In order to match time use information with goods information, I consider only single-headed households and children in those dwelling units.[13] I restrict the sample

[9] Between time and market goods, the most expensive thing that we spend is our time. In spite of this fact, the availability of time use surveys relative good expenditure surveys is sparse. See Abraham (2005) for an excellent description of the nascent field on time use. For more information about the ATUS see Hamermesh, Frazis, and Stewart (2005).

[10] All ATUS results are weighted by day of the week to account for this fact.

[11] The 441 categories are organized into 3 tiers.

For personal activities, the BLS does not collect information on where an activity takes place and who was present. Personal activities are: sleeplessness, sleeping, washing, dressing and grooming oneself; grooming health-related self care, other self care, personal/private activities, other personal activities, personal emergencies, personal care emergencies, and other personal care.

[12] The respondent in the CEX, however, reported the expenditures for all of the persons in the consumer unit.

[13] I do not consider how children spend their time. See Apps and Rees (2001) for a household approach that assumes a utility function for each individual in the household,

to households that could have children, those between the ages of 18 and 65, and exclude children if they have any marital status other than never married. In additional to one's children, I also include foster children and one's own non-household children, but I exclude one's grandchildren and other relatives. From the 441 possible categories, I define an individual's time use into four categories: work, sleep, child care, and leisure.[14]

My definition of child care time is broader than the child care definition in the ATUS questionnaire. In addition to activities identified as child care related in the ATUS, I also include activities where a child under the age of 18 is present and there are no other adults present other than the respondent. Is this broader definition of child care too generous? Perhaps. But if so, then the results that follow may be interpreted as upper bounds. However, this upper bound is what has been missing from the literature on the cost of children. For decades, economists have estimated the market good cost of a child and excluded the larger, and perhaps harder to substitute, time costs. By excluding time costs, welfare transfers are implicitly expected to cover the entire cost of a child, when in fact it may be the time spent with a child is the more important expenditure in raising a child, and not just the time spent, but time spent with all of the "good" unobservables.

Single households with a child and single households without a child differ along important and expected dimensions (see Table 2.1). A typical single parent is a black young women, is employed, and has less than average level of education. Seventy-two percent of single parents are women. More

including children.

[14]Instead of the category leisure I experimented with two exhaust and mutually exclusive catergories, adult care and leisure. Both of these categories moved in the same direction in nearly all of the conditional means. To simplifiy the imputations, I combined both of these categories into one.

single parents are employed than single adults without children – 82 and 74 percent, respectively. Single parents are less educated than other singles and are more likely to be divorced or separated.

The presence of a child in single-headed households reduces leisure time, but work and sleep times remain unchanged. The percent of a day spent in each of the four time categories, given the presence of child, is in Column 2, Table 2.2a.[15] Households without a child spend about 50 percent of the day in leisure time, 35 percent of the day sleeping, and 15 percent of the day working.[16] Households with a child spend 30 percent of the day in leisure and 15 percent of the day in child care time.[17]

For single female, but not for male headed households, child care time decreases as the age of the child increases (Row 1 in Tables 2.2a and 2.2b, respectively). Single women spend 20 percent of their time in child care if their child is younger than 7 years old. They spend 10 percent of their time in child care if their child is older than 13. Men, however, consistently spend about 15 percent of their time with their child. Nursing and infant care may explain the relatively large amount of time that women spend with their young children, but it is unclear why time spent with older children decreases for women below the amount of time spent by men with children.[18]

[15] These statistics are weighted by the day of the week. The time shares represent the average time share for an average day of the week of the observations in that cell.

[16] Leisure time is defined as personal time, housework, eating, drinking, watching TV, etc.

[17] Drawing on various studies, Crittenden (2001) claims that the presence of a child reduces a mother's time for all other time activities except for paid work time.

[18] Systematic patterns are not evident in time shares by income categories. This may be because incomes do not necessarily map into the opportunity cost of individuals if incomes are not solely determined by wages and salaries but instead include transfer payments and non-labor income.

Table 2.1: Summary Statistics on Single-Headed Households in the 2003 and 2004 American Time Use Surveys

	No Child Present		One Child Present	
	Mean	Std. Err.	Mean	Std. Err.
Gender (1=Male)	0.47	0.007	0.18	0.006
Age	46.60	0.704	37.88	1.252
Race				
White	0.75	0.011	0.71	0.024
Black	0.20	0.003	0.24	0.008
Other	0.05	0.001	0.04	0.001
Region				
Northeast	0.20	0.003	0.18	0.006
South	0.36	0.005	0.37	0.012
Midwest	0.24	0.004	0.24	0.008
West	0.20	0.003	0.20	0.007
Marital Status				
Married - Spouse Absent	0.02	0.000	0.02	0.001
Widowed	0.09	0.001	0.05	0.002
Divorced	0.38	0.006	0.44	0.014
Separated	0.05	0.001	0.12	0.004
Never Married	0.45	0.007	0.37	0.012
Child's Gender (1=Male)	--	--	0.51	0.017
Child's Age	--	--	9.24	0.306
Education				
HS or less	0.35	0.005	0.39	0.013
BA or some college	0.51	0.008	0.54	0.018
Graduate work	0.13	0.002	0.07	0.002
Employment Status				
Employed	0.74	0.011	0.82	0.027
Unemployed	0.04	0.001	0.05	0.002
Not in Labor Force	0.21	0.003	0.13	0.004
Total Annual Income (before taxes)	$36,903	$597	$31,256	$1,087
Number of Observations	4,376		915	

Note: Information on Total Annual Income is missing for a few observations.

Table 2.2a: Daily Time Shares for Single Female-Headed Households With No Children, With One Child, and by Age of Child

			Age of Child		
Activity	No Children	One Child	0 - 7	8 - 12	13 - 17
Child Care	0.20%	15.6%	21.0%	14.9%	9.1%
Leisure	48.8%	32.3%	27.5%	33.4%	37.4%
Work	15.5%	16.1%	14.3%	16.6%	17.9%
Sleep	35.4%	36.1%	37.2%	35.1%	35.6%
Number of Observations	2321	751	295	240	216

Note: These data are from the 2003 and 2004 American Time Use Survey. The total number minutes in a day is 1440. The statistics are weighted by the day of the week (i.e. Sunday, Monday, ..., Saturday).

Table 2.2b: Daily Time Shares for Single Male-Headed Households With No Children, With One Child, and by Age of Child

			Age of Child		
Activity	No Children	One Child	0 - 7	8 - 12	13 - 17
Child Care	0.36%	14.1%	14.2%	14.5%	13.6%
Leisure	47.2%	33.7%	31.4%	35.7%	33.0%
Work	17.5%	17.4%	20.4%	15.1%	18.0%
Sleep	34.9%	34.8%	34.0%	34.8%	35.5%
Number of Observations	2055	164	41	66	57

Note: These data are from the 2003 and 2004 American Time Use Survey. The total number minutes in a day is 1440. The statistics are weighted by the day of the week (i.e. Sunday, Monday, ..., Saturday).

2.4.2 Consumer Expenditure Survey

The goods expenditure data set I use is the 2003 CEX. The 2003 CEX contains cross-sections on five quarters: 1st Quarter 2003 through 1st Quarter 2004. Though the same individual or consumer unit may appear in a following quarter, the sampling scheme allows one to combine all of the cross-sections into one pooled sample. I use the same restrictions and definitions that I described above for the ATUS.

In the summary statistics, the ATUS and the CEX are remarkably similar (see Table 2.3). As in the ATUS, the average age of a single parent is 38, the average child's age is 9, and 51 percent of the children are boys. A typical single parent has the same education, employment, and race profile as in the ATUS: black, employed, and below average level of education.

Budget share decreases and increases for households with one child versus households without a child follow expected patterns (see Tables 2.4a and 2.4b). Households with one child spend more of their budget on food at home, child care, children's apparel, and shelter, than households without a child. The greatest increase in expenditures is in food at home followed by child care. For fathers, the greatest increase in expenditures is the opposite: child care followed by food at home. These increases come from reductions in alcohol, cash contributions, and other apparel. Moving from lesser to higher income categories, child care expenditures increase for single mothers and decrease for single fathers. For both mothers and fathers, expenditures on food and apparel decrease as incomes increase. In aggregate expenditure categories, however, single mothers and single fathers have similar budget allocations.[19]

[19]Expenditure shares by a child's gender are very similar, thus suggesting that there is not a goods expenditure gender bias. For evidence on gender biases in Asian cultures see

Table 2.3: Summary Statistics on Single Headed Households in the 2003 Consumer Expenditure Survey

	No Child Present		One Child Present	
	Mean	Std. Err.	Mean	Std. Err.
Gender (1=Male)	0.54	0.006	0.21	0.007
Age	40.17	0.445	38.07	1.193
Race				
White	0.80	0.009	0.73	0.023
Black	0.13	0.001	0.25	0.008
Other	0.06	0.001	0.03	0.001
Region				
Northeast	0.18	0.002	0.16	0.005
South	0.32	0.004	0.35	0.011
Midwest	0.23	0.003	0.25	0.008
West	0.26	0.003	0.24	0.007
Marital Status				
Married - Spouse Absent	0.03	0.000	0.04	0.001
Widowed	0.07	0.001	0.04	0.001
Divorced	0.29	0.003	0.49	0.015
Separated	0.05	0.001	0.11	0.004
Never Married	0.57	0.006	0.32	0.010
Child's Age	--	--	0.51	0.016
Child's Gender (1=Male)	--	--	9.72	0.305
Education				
HS or less	0.31	0.003	0.39	0.012
BA or some college	0.59	0.007	0.54	0.017
Graduate work	0.10	0.001	0.06	0.002
Total Annual Income (before taxes)	$25,871	$286	$27,670	$867
Total Annual Expenditures	$24,834	$275	$29,126	$913
Number of Observations	8,164		1,018	

Table 2.4a: Budget Shares for Single Female-Headed Households by Number of Children and Age of Child

				Age of Child		
Activity		No Children	One Child	0 - 7	8 - 12	13 - 17
Expenditures	*Mean*	$5,798	$6,614	$5,622	$6,835	$7,521
	S.E.	81	182	270	328	337
Budget Shares						
Food at Home		8.81%	11.57%	13.03%	11.07%	10.73%
Food Away		3.37%	3.28%	2.79%	3.10%	3.79%
Child Care		0.02%	2.18%	5.45%	1.44%	0%
Domestic Service (excluding Child Care)		0.49%	0.35%	0.19%	0.44%	0.43%
Boys' Apparel		0.07%	0.38%	0.46%	0.42%	0.29%
Girls' Apparel		0.08%	0.70%	0.62%	0.84%	0.66%
Toys and Play Equipment		0.23%	0.54%	0.95%	0.54%	0.22%
Women's Apparel		2.24%	1.35%	1.20%	1%	1.52%
Shelter		25.80%	26.39%	25.13%	27.91%	26.38%
All Other Expenditures		58.89%	53.26%	50.17%	52.96%	55.95%
Number of Observations		3,758	806	309	210	287

Note: These statistics are from the 2003 Consumer Expenditure Survey, Quarters 1-4 in 2003 and Quarter 1 in 2004. Each cell is the budget share of those in the cell. Each budget share is based on expenditures over one quarter.

Table 2.4b: Budget Shares for Single Male-Headed Households by Number of Children and Age of Child

				Age of Child		
Activity		No Children	One Child	0 - 7	8 - 12	13 - 17
Expenditures	*Mean*	$6,559	$9,819	$9,077	$9,990	$10,211
	S.E.	92	503	768	1204	754
Budget Shares						
Food at Home		8.41%	9.37%	9.64%	9.12%	9.33%
Food Away		4.86%	4.28%	3.95%	3.49%	4.82%
Child Care		0.06%	1.59%	4.51%	1.46%	0%
Domestic Service (excluding Child Care)		0.29%	0.37%	0.45%	0.52%	0.25%
Boys' Apparel		0.05%	0.33%	0.24%	0.52%	0.28%
Girls' Apparel		0.04%	0.36%	0.51%	0.46%	0.24%
Toys and Play Equipment		0.18%	0.49%	0.53%	0.71%	0.36%
Women's Apparel		0.10%	0.11%	0.08%	0%	0.18%
Shelter		23.88%	21.15%	20.09%	19.65%	22.42%
All Other Expenditures		62.13%	61.97%	59.99%	64.06%	62.12%
Number of Observations		4,406	212	64	47	101

Note: These statistics are from the 2003 Consumer Expenditure Survey, Quarters 1-4 in 2003 and Quarter 1 in 2004. Each cell is the budget share of those in the cell. Each budget share is based on expenditures over one quarter.

Time Imputations

Except for work time, information on time expenditures is not included in the CEX. Without information on time, information on the largest component of full expenditures is not available. To create a data set with both time and goods expenditure information, I impute leisure time for each individual in the CEX from the ATUS, using variables common to both data sets.

To do this, I assume sleep time is constant for all individuals and use the constraint that all activities must sum to the total amount of time available in a day, 1440 minutes.[20] Sleep times across households with and without a child, and across the ages of a child, vary only slightly (see Row 4, Table 2.5). The average amount of daily sleep time is 520 minutes, or about 35 percent of a day. Households with the highest amount of sleep are single households with young children: 535 minutes or 37 percent of the day. Households with the least amount of sleep are singles without children and singles with an older child: 518 minutes or 36 percent of the day.

Lee and Paik (2006).

[20] Work time in the CEX is reported in weekly hours, time activities in the ATUS are reported in daily minutes.

Table 2.5: Imputed Daily Time Shares for Single Female-Headed Households by Number of Children and Age of Child

					Age of Child					
	No Children		One Child		0 - 7		8 - 12		13 - 17	
	ATUS	CEX	ATUS	CEX	ATUS	CEX	ATUS	CEX	ATUS	CEX
Child Care	0.3%	0%	16.1%	15.6%	20.7%	20.7%	15.9%	14.3%	9.9%	10.9%
Leisure	48.5%	45.9%	31.8%	28.9%	27.8%	25.5%	32.2%	29.3%	36.7%	32.2%
Work	15.3%	18.0%	15.5%	19.4%	14.2%	17.6%	15.3%	20.3%	17.4%	20.7%
Sleep	36.0%	36.1%	36.7%	36.1%	37.2%	36.1%	36.6%	36.1%	36.0%	36.1%
Weekly Minutes of Work	1,566	1,817	1,622	1,957	1,445	1,777	1,676	2,043	1,802	2,089
Number of Observations	2,321	3,758	751	806	295	309	240	210	216	287

Note: These data are imputed from the 2003 and 2004 American Time Use Surveys. The statistics are weighted by the day of the week (i.e. Sunday, Monday, ..., Saturday). In the CEX, sleep time is assumed to be constant for all individuals, work is known in the CEX, leisure is imputed from the ATUS, and child care time is calculated by the adding up identity.

As the human body requires sleep in order to function, over periods of time, the amount of time one sleeps is constant, although increases in child care or work time may temporarily decrease sleep time.[21] Because sleep time does not vary, and to avoid adding more measurement error to the imputations and final data, I assume that all individuals in the CEX sleep on average of 520 minutes a day or 36.1 percent of a day. This leaves two remaining time categories to impute into the CEX: leisure time and child care time. (Recall that work time is in both the ATUS and the CEX and hence does not need to be imputed.)

Imputing leisure time is not straightforward. A kernel density estimate of leisure time in the ATUS shows that its distribution is bimodal. By sorting individuals by full-time work status, the distribution splits into two unimodal distributions. With this partition of the data, I impute leisure time by regressing leisure in the ATUS on variables common to both the ATUS and the CEX. These variables include: race, marital status, age, education, age of child, gender of child, education of child, weekly work time, and occupation. I regress leisure separately by presence of child and employment status.[22] [23]

With the estimates from these regressions in the ATUS, I impute the values for leisure into the CEX. As is often the case with imputations, the variance of the imputed variable is smaller than the variance of the imputing variable. To adjust for this, I adjust the variance of the imputed variable in the

[21] Daily sleep time decisions, on the contrary, do depend on labor-leisure trade-offs. For more on this see Hamermesh and Biddle (1990).

[22] I split the data by those who work more than (or less than) 325 minutes of work. Other splits, 300, 350, and 375, yield similar but not identical results.

[23] An alternative approach is to impute child care time and then calculate leisure time. This is approach fraught with even more difficulty because nearly three-quarter of the observations for child care time are zeros.

CEX, leisure, to equal the variance of leisure in the ATUS. With work, sleep, and leisure time, I then calculate child care time by the adding up condition that the total minutes in a day equal 1,440. If the sum of those four categories is larger than 1,440, then I reduce leisure time until the constraint is satisfied.[24]

The imputation procedure works well (compare Column ATUS, actual times, with Column CEX, imputed times, in Table 2.5). Sleep time is fixed at 36.1 percent or 520 minutes. Work time is reported in the CEX, and hence is not the result of calculations or imputations. Leisure time is imputed and child care time is the remaining time from the adding up constraint. Given that work time and sleep time are "correct," it is clear that CEX differences in leisure time are generated mainly from differences in work and sleep time. Child care time imputations in the CEX are very similar to ATUS child care values.

To understand how well the imputations are working, I impute back onto the ATUS and compare the imputed values with the original values to verify that the imputations of leisure time are reasonable. The means of the non-imputed leisure times for all households, households without a child, and households with a child are, respectively: 696, 724, and 581 minutes. The imputed values back onto the ATUS, with the same right-handside variables, are, respectively: 706, 737, and 580 minutes. The means for each partition of the data are very close.

Wage Imputations

To avoid endogeneity of wages, and to generate a wage for non-workers, I impute wages into the CEX from the 2003 and 2004 Current Population Sur-

[24]The constraint is exceeded in only a handful of cases.

vey (CPS) Merged Outgoing Rotation Group files, otherwise known as the MORG files (Bureau of Labor Statistics, 2004b; Feenberg and Roth, 2005). The 2003-2004 MORG data set has 76,916 households without a child and 45,705 households with a child.[25] On the MORG sample, I regress a Mincerian wage equation separately for both males and females and by whites and non-whites. I use a Heckman model to estimate the wages of all heads of households in the MORG files and then project those estimates onto heads of households in the CEX. I use information about the child as instruments and characteristics of the head of household and state dummy variables as regressors. With the coefficients from these regressions, I predict the wages for individuals with and without wage information in the CEX.[26]

I derive time prices from market wages as characterized in the MORG files. For the price of leisure time, I use the imputed wage from the MORG files using demographic information in both the CEX and the MORG. For the price of child care time, I impute what the individual would make if they were employed in the child care industry.[27]

A recent report suggests another method for valuing home production: quality-adjusted replacement cost (see Abraham and Mackie, 2005, page 70). The idea is that Professor Smith may be a good economist, but he is likely a terrible plumber. Thus, if Smith was in the plumbing labor market, he would

[25] In the MORG files, age, sex, and education information are not available for children under the age of 15.

[26] As suggested in the MORG documentation, these observations are individuals who are not self-employed and do not have top-codes for weekly wages. Hourly wages are computed by dividing weekly wages by weekly hours. For more information about the MORG files see Feenberg and Roth (2005).

[27] In the estimation of the demand system, I normalize imputed wages and imputed child care wages the respect wages of a white female who is, without a child, 30 years old, and a high school graduate.

be paid less than the average wage. By the same argument, however, one may be over qualified for an activity that one does at home, for example, child care. It is unclear if the quality-adjusted replacement cost method would yield a lower or higher estimate than the market replacement wage. What may be more important is distinguishing labor from leisure (Kimmel and Connelly, 2006). Child care time is clearly work, but often times enjoyable work. This is the paradox that volunteers face: Is volunteering labor or leisure (see Chapter 3 for a discussion of the volunteer labor force)?

Larson and Shaikh (2004) suggest a non-linear relationship between wages and the value of time, with value of time as a proportion of the wage but then remaining constant past a $30 an hour wage. Unfortunately, their sample size is small, 393 individuals, and the leisure activity that they derive the results from is whale watching (see Table 4 in Larson and Shaikh, 2004).

Goods Prices

For goods prices I use the CPI and internal computations by the BLS. The CPI describes price variation across time for a given area and for given goods (Bureau of Labor Statistics, 2004a, pg. 6). If prices are too similar or they do not vary, then the Hessian matrix can not be inverted and demand estimates can not be obtained. Because I use only one year of the CEX, the CPI may not have enough price variation to estimate a demand system. In order to increase the amount of price variation, I construct indices that are comparable across areas and time by using the price levels constructed by Kokoski, Cardiff, and Moulton (1994) and the CPI price indices from 1989 to 2003.

Though, in general, prices move together across both time and regions, differences in regional prices are sufficient to generate large welfare differences

(Slesnick, 2002). Slesnick (2005) discusses the measurement error of assuming that all households in the US faces the same prices. With area and time comparable price indices and information on goods and time expenditures, a household demand system for input goods to the household production function can be estimated. For details about the construction of these prices, including tables, see the Appendix, Cost of Children section.[28]

A recent study on prices by Bettina Aten computes 2003 prices levels (Aten, 2005, 2006). These price levels incorporate recent CPI categories and area definitions. As described in the Appendix with 1988/89 prices from Kokoski, Cardiff, and Moulton (1994), I inflate the prices levels from Aten (2005) across areas for 2003 and 2004 to create inter-area comparable prices indices over the time frame of the analysis. I perform the analyses described in the Empirical Strategy Section with both these price indices and the prices indices constructed from Kokoski, Cardiff, and Moulton (1994). The results I report in the next section are with the price indices created from Aten (2005), since they are more recent and have less measurement error than indices based on Kokoski's 1988/1989 price levels.

2.5 Results

In this section, I discuss implications from the combined time and goods data set and report the elasticities and equivalence scales I compute with these data.

[28] In the estimation, I normalize goods' prices by the United States city average.

2.5.1 Means

Summary statistics of time and goods expenditures confirm that the largest cost of a child is child care time (see Table 2.6a), and the most time intensive age is the 0 - 7 age group (see Table 2.6b). Child care time for a young child is about 30 percent of full expenditures. On the other hand, child care time for an older children is about 15 percent of full expenditures, which is half of the time requirement for a young child. In goods expenditures, the cost of a younger child appears to be less than that of an older child. This, however, may be due to heterogeneous income levels, which are not controlled for in these tables.[29] The time component of full expenditures is roughly twice as large as the goods component. For households with a young child, the leisure time alone is similar in magnitude to total goods expenditures. These shares are upper bounds on behavior, as they do not account for the fact that households may substitute away from more expensive goods to less expensive goods.

[29] For example, parents with older children are likely themselves to be older and hence have higher wages and expenditures than parents with younger children.

Table 2.6a: Time, Goods, and Full Income for Single Female-Headed Households With No Children and With One Child

	Hours or Dollars		Percent of Hours or Dollars		Full Expenditure		Percent of Full Expenditure	
Expenditures	No Children	One Child	No Children	One Child	No Children	One Child	No Children	One Child
Time								
Child Care	0	340	0.0%	23.6%	$0	$3,801	0.0%	21.3%
Leisure	1,002	631	69.6%	43.8%	11,817	7,410	67.1%	41.6%
Work	394	424	27.3%	29.5%	5,189	5,220	--	--
Time Subtotal	--	--	--	--	$11,817	$11,211	67.1%	62.9%
Goods								
Food	$706	$982	12.2%	16.9%	$706	$982	4.0%	5.5%
Housing	1,770	2,125	30.5%	36.6%	1,770	2,125	10.1%	11.9%
All Other Expenditures	3,321	3,507	57.3%	60.5%	3,321	3,507	18.9%	19.7%
Goods Subtotal	--	--	--	--	$5,798	$6,614	32.9%	37.1%

Note: The unit of observation is a household. The time span is one quarter. The number of observations for those without children is 3,758 and for those with one child it is 806.

Table 2.6b: Time, Goods, and Full Income for Single Female-Headed Households by Age of Child

	Hours or Dollars			Percent of Hours or Dollars			Full Expenditure			Percent of Full Expenditure		
	Age of Child			Age of Child			Age of Child			Age of Child		
Expenditures	0-7	8-12	13-17	0-7	8-12	13-17	0-7	8-12	13-17	0-7	8-12	13-17
Time												
Child Care	453	312	238	31.4%	21.7%	16.6%	$4,572	$3,655	$3,077	29.0%	20.0%	15.6%
Leisure	557	640	704	38.7%	44.5%	48.9%	5,547	7,767	9,155	35.2%	42.5%	46.3%
Work	385	443	453	26.7%	30.7%	31.4%	4,118	5,488	6,212	--	--	--
Time Subtotal	--	--	--	--	--	--	$10,119	$11,422	$12,232	64.3%	62.6%	61.9%
Goods												
Food	$889	$969	$1,092	15.8%	14.2%	14.5%	$889	$969	$1,092	5.6%	5.3%	5.5%
Housing	1,707	2,297	2,448	30.4%	33.6%	32.5%	1,707	2,297	2,448	10.8%	12.6%	12.4%
All Other Expenditures	3,025	3,568	3,981	53.8%	52.2%	52.9%	3,025	3,568	3,981	19.2%	19.5%	20.2%
Goods Subtotal	--	--	--	--	--	--	$5,622	$6,835	$7,521	35.7%	37.4%	38.1%

Note: The unit of observation is a household. The time span is one quarter. The number of observations for the 0-7 age group is 309, for the 8-12 age group it is 210, and for the 13-17 age group it is 287.

2.5.2 Elasticities

Own-price demand elasticities for market goods are negative and have the expected magnitudes (see Tables 2.7a and 2.7b). The own-price elasticities for food and other goods are similar to LES elasticities computed by Pollak and Wales (1992, see Tables 1 and 2).[30] The own-price elasticity of food is between -0.627 and -0.796. The own-price elasticity of leisure is between -0.36 and -0.73. The elasticity of child care is smaller for those who work than for all others. For those with children, the elasticity of child care is -0.213, and for those with children and are also employed the own-price child care elasticity is -0.043. In general, the more constrained the household, the smaller are their own-price elasticities.

These elasticities do not include the effect of a change of wage, or price of time, on total income. Recall that goods expenditures are financed through earned wages, unearned income, and savings or borrowings. A more appropriate elasticity is one that allows for the change in wage to also affect the size of the goods expenditure component of full expenditures. (See comments in the Theory Section and Thompson, 2004, for more regarding this point.)

The labor supply elasticities derived from the demand for leisure and child care are larger than the labor elasticities directly calculated with hour and wage information from the CEX. For employed households with children, the labor supply elasticity is 0.40. The labor supply elasticity for the same type of household in the CEX is 0.12. The difference between these two elasticities is due in part to household production. The CEX labor supply elasticity is directly estimated by regressing log hours on a constant term and log wages. The

[30] See also Raper, Wanzala, and Nayga (2002).

Table 2.7a: Time and Goods LES Elasticities for Single Female Headed Households by Presence of Child and Employment

No Child Present

	Food at Home	Housing	Other Goods	Leisure (wage)	Income
Food	-0.785	0.005	0.111	-0.334	1.00
Housing	-0.013	-1.049	0.152	-0.456	1.37
Other Goods	-0.020	0.011	-1.391	-0.701	2.10
Leisure	-0.006	0.004	0.073	-0.731	0.66

No Child Present and Employed

	Food at Home	Housing	Other Goods	Leisure (wage)	Income
Food	-0.796	0.002	0.153	-0.603	1.24
Housing	-0.016	-1.015	0.198	-0.783	1.62
Other Goods	-0.025	0.005	-1.296	-1.237	2.55
Leisure	-0.004	0.001	0.049	-0.449	0.40
			Labor Supply Elasticity	0.82	
			Labor Supply Elasticity (CEX)	0.35	

Note: The number of observations for those without a child is 2,939.

Table 2.7b: Time and Goods LES Elasticities for Single Female Headed Households by Presence of Child and Employment

Child Present

	Food at Home	Housing	Other Goods	Leisure (wage)	Child Care (cc wage)	Income
Food	-0.705	0.002	0.154	-0.149	-0.156	0.85
Housing	-0.025	-1.019	0.228	-0.221	-0.232	1.27
Other Goods	-0.047	0.006	-1.477	-0.411	-0.432	2.36
Leisure	-0.014	0.002	0.124	-0.674	-0.126	0.69
Child Care	-0.005	0.001	0.042	-0.041	-0.231	0.23

Child Present and Employed

	Food at Home	Housing	Other Goods	Leisure (wage)	Child Care (cc wage)	Income
Food	-0.627	-0.014	0.135	-0.270	-0.212	0.99
Housing	-0.038	-0.908	0.199	-0.398	-0.313	1.46
Other Goods	-0.069	-0.038	-1.255	-0.726	-0.570	2.66
Leisure	-0.011	-0.006	0.056	-0.361	-0.088	0.41
Child Care	-0.001	-0.001	0.007	-0.014	-0.043	0.05
				Labor Supply Elasticity	0.40	
				Labor Supply Elasticity (CEX)	0.12	

Note: The number of observations for those with a child is 667.

elasticity calculated using the CEX data set includes the impact of domestic labor supply and the impact of wages on goods expenditures on market labor supply. The labor supply calculated from the demand system described above is calculated from leisure and child care elasticities. These elasticities do not capture the effect of market labor supply on the amount of market goods than can be purchase, nor do they acknowledge that domestic labor is necessary to consume market goods. Thus, part of the difference in the calculated labor supply and the directly estimated labor supply represent household production and the full expenditure component of labor supply.

2.5.3 Equivalence Scales

As put forth in the in the Empirical Strategy Section, in this section I report the equivalence scales for goods, time, and time and goods together. The first two specifications, equivalence scales based on goods and equivalence scales based on time, are mis-specified. Neither takes into account that the other is necessary in order to consume them. The correct specification for household demand for inputs includes both time and goods.

Similar to other studies (Betti, 1999), the goods cost of a child is about 20 percent of the cost of an adult (see Table 2.8a). The cost of two young children is 53 percent of the cost of an adult. Two children in the same age bracket are more expensive than two children in different age brackets. For example, two young children require two car seats and perhaps a larger car for the both of them to ride in. Children who have are further apart in age can share some of the same goods, such as a child seat, thus reducing total goods expenditures.

Table 2.8a: Goods and Time LES Equivalence Scales and Cost Functions

Number of Children by Age Group			Equivalence Scales			Cost Functions		
0-7	8-12	13-17	Goods	Time	Goods and Time	Goods	Time	Goods and Time
0	0	0	1.00	1.00	1.00	$5,248	$11,748	$17,536
1	0	0	1.21	1.92	1.91	$6,370	$22,567	$33,580
0	1	0	1.21	1.67	1.69	$6,343	$19,584	$29,697
0	0	1	1.21	1.57	1.55	$6,373	$18,400	$27,235
2	0	0	1.53	1.95	1.98	$8,013	$22,950	$34,802
1	1	0	1.34	1.80	1.85	$7,046	$21,139	$32,360
1	0	1	1.45	1.81	1.88	$7,613	$21,322	$32,923
0	2	0	1.37	1.74	1.78	$7,181	$20,457	$31,141
0	1	1	1.27	1.60	1.61	$6,639	$18,799	$28,227
0	0	2	1.42	1.62	1.68	$7,465	$19,066	$29,383

Note: The reference household is a single female.

There are significant economies of scale with time. The time equivalence scale for one young child is 1.92, meaning a child costs 92 percent of the costs for an adult.[31] The time equivalence scale for two young children is 1.95, meaning that two children cost 95 percent of the costs for an adult. Time watching one young child can easily be spent watching another young child.

One could argue that this result is an artifact of the liberal definition of child care time that I use. If so, the above represents an upper bound; however, does not child care include just that, watching or monitoring children? The question is not just about the definition of child care, but acknowledging that individuals may do many activities at the same time, and then asking how to quantify such. For example, watching TV, eating, and surfing the Internet, is an example of where an individual can consume more leisure without using more time to consume it.

The monetary cost of a child is much greater with the inclusion of time. With the mis-specified equivalence scale with goods only, a child costs $1,000 per quarter (see the differences between the cost function in Row 1, a single adult, and Row2, a single adult with a young child, in Column 7, Table 2.8b). With only time, and not goods, the cost of a child is $11,000 per quarter (see Row 1 and Row2 in Column 8). The time costs of a child are ten times the goods cost of a child. The time and goods cost of a child is about $16,000 per quarter (see Row 1 and Row 2 in Column 9).[32]

[31] Apps and Rees (2001) find similar costs for a child. With some assumptions on household production, they estimate that the cost of a child is between 80 to 90 percent of the cost of an adult.

[32] The fact that the time and goods equivalence scale tracks the time equivalence scale is due to large influence of time on the cost of a child.

Table 2.8b: Goods and Time LES Equivalence Scales and Cost Functions with Difference Assumptions of the Value of Time

Number of Children by Age Group			Goods and Time Equivalence Scales			Goods and Time Cost Fuctions		
0-7	8-12	13-17	w/3	CCw/3	w/3 & CCw/3	w/3	CCw/3	w/3 & CCw/3
0	0	0	1.00	1.00	1.00	$9,704	$17,536	$9,704
1	0	0	2.75	1.38	1.70	$26,724	$24,168	$16,472
0	1	0	2.23	1.29	1.50	$21,678	$22,684	$14,550
0	0	1	1.87	1.23	1.37	$18,130	$21,567	$13,261
2	0	0	2.93	1.41	1.78	$28,394	$24,811	$17,269
1	1	0	2.62	1.35	1.64	$25,394	$23,679	$15,894
1	0	1	2.64	1.36	1.65	$25,635	$23,907	$16,011
0	2	0	2.44	1.32	1.56	$23,691	$23,117	$15,152
0	1	1	2.02	1.26	1.43	$19,560	$22,100	$13,843
0	0	2	2.15	1.29	1.48	$20,817	$22,686	$14,375

Note: The reference household is a single female. The wage is denoted "w" and the child care wage is denoted "CCw."

The cost of a child using both time and goods is greater than the sum of the costs of time and of the costs of goods because of household production. Equivalence scales based only on time ignore the goods inputs into household production of a household community, such as a meal. Equivalence scales based separately on time and goods are lower bounds of the true commodity cost of a child. Comparing demand systems based separately on time and goods with a demand system based on time and goods illustrates the importance of acknowledging the household production function in household consumption.

Equivalence Scales with Different Prices of Time

Above I assume that the price of leisure time is the imputed wage rate and that the price of child care time is the imputed wage rate for a child care provider with the parent's age and education. Clearly, these may not be correct. For example, Larson and Shaikh (2004) show that the value of leisure time is non-linear, that it departs from tracking the hourly wage for wages higher than $30. I experiment with prices of time that are proportional to the wage rate and the child care wage rate. (See Table 2.8b for equivalence scales for time and goods with different assumptions on the price of time.)

In the equivalence scales in Column 4, I assume that the price of leisure time is equal to one-third of the wage rate. With this assumption, the equivalence scales are much larger, and the quarterly monetary cost of a child is about $17,000, the same as before. Monetary costs remain the same because child care time costs have not changed, only leisure costs; what will differ are elasticities based on these prices. The equivalence scales are larger because the percent of full income devoted to child care cost is now much larger, and

the percent of full income devoted to leisure time is much smaller. As leisure time becomes less expensive, the percent of full income devoted to time child care costs increases.

In Column 5, I define the price of child care time as one-third the market rate for child care, and I return the price of leisure to the wage rate. With this assumption, equivalence scales decrease considerably. Instead of a child costing 90 percent of an adult, now they cost less than 40 percent of an adult. Obviously, with a lower time cost of child care, children cost less.[33]

2.6 Conclusion

I use the Linear Expenditure System to construct equivalence scales using Pollak and Wales' (1978) translation methodology. The demand system and the method for capturing demographic variation is basic; yet it sufficiently captures the idea that time and goods must be considered together when estimating the cost of children. With this methodology and data from the ATUS, CEX, and CPI, I find that the time costs of a child, holding utility constant, is more than ten times larger than the goods cost of a child.

In terms of family and child support litigation that draws on calculations of the time and goods cost of children, the question will be: What is the time cost of child care? The objective of defendants will be to find the highest price for leisure time and the lowest cost for child care time. With the wage as the

[33] In Column 6, I consider the price of child care time as one-third of the market rate for child care and the price of leisure as one-third of the wage. The cost function for a household with no children under these assumptions is the same as under the assumption of only a reduced price of leisure (see Columns 7 and 9, Row 1). This is because a household with no children has no child care costs, and thus a change in the price of child care time does not affect the cost function. For these reasons, the cost of a child in under these assumptions is the same as in Column 7.

price of leisure and the price of child care at 1/3 of the market cost for child care, the quarterly cost of a child for a single mother is $7,000. This is still seven times the cost of a child calculated with only household expenditures on goods. It is time, more than goods, which are required for raising children.

2.6.1 Further Research

Extensions to the above include using a more flexible demand system, more flexible elasticities, and more metrics of the cost of children.

The LES is a translation of a constant elasticity of substitute utility function, which may be too simple to characterize household preferences. One extension is to use the Quadratic Expenditure system (QES). Early on in this project, I considered the Almost Ideal Demand System of Deaton and Muellbauer (1980) with the price scaling method for capturing demographic variation put forth by Ray (1983). Obtaining reasonable parameter estimates in this framework was difficult. Computing the Deaton and Muellbauer model with Pollak's translation methodology may prove more fruitful.[34]

The elasticities that I presented in this chapter do not account for the effect of prices on full income. I assumed that the price of leisure was equal to the wage rate. Therefore, a change in the wage rate not only affects the price of leisure, but it also affects the total amount of earned income available to purchase market goods. The change in wage has both a substitution and income effect.

Another approach to measuring the value of time is to apply a function to the wage rate. For example, Larson and Shaikh (2004) suggest that the

[34]Filippini (1995) considers a minimalist approach by looking at electricity consumption.

value of time is half of the wage rate until the wage rate is $30; after that the value of time is constant at $15 an hour. This would reduce the value of leisure time for those with high wages and leave the price of child care time unchanged. One effect of applying such a function to the value of leisure time would be higher equivalence scales.

Finally, one could use other methods for measuring demographic effects on demand. Above, I used the translating method, but there are also a host of other methods to consider.[35]

[35] Pollak and Wales (1981) offer a number of different methods for including demographic variables in demand analysis

Chapter 3

The Return to Donations of Time

3.1 Introduction

Do classroom parent volunteers increase test scores? A large body of research suggests that marginal increases in inputs to education, such as teacher salaries, student/teacher ratios, and certifications, have little if any affect on test scores, but that home and family environments significantly do affect test scores (Coleman, Campbell, Hobson, McPartland, Mood, Weinfeld, and York, 1966). It remains unclear how home-based inputs affect test scores when they are placed inside of a classroom. I estimate the productivity of classroom parent volunteers in elementary schools with first grade standardized test scores. These data are from the 1998/99 Early Childhood Longitudinal Survey. In addition to controlling for family characteristics, I separately identify the effect of volunteering on the volunteer's child and the effect of volunteering on

other children in the classroom. I also instrument for the endogeneity of volunteering.

Volunteers are inherently different than other educational inputs. Volunteers bring with them a host of unobservables that are traditional found in the home. First, volunteers have different motivations than do teachers. Parent volunteers have a longer time horizon of interest in their child's performance whereas a paid employee may only focus on the end of the year or semester. Second, volunteers are not under the explicit control of teachers or principals. More so than a teaching aide, they may be perceived by a teacher as a supervisor or monitor, validating the teaching and administration of the classroom. Another difference is that teachers and teaching aides are paid. This may limit the scope of their involvement with a student whereas volunteers are often willing to do many tasks that they would not have done if they were paid.

Many studies have found large effects on test scores originating from a student's home environment (Coleman, Campbell, Hobson, McPartland, Mood, Weinfeld, and York, 1966; Hanushek, 1996, 1997) and from unobservables related to teachers, students, and households.[1] Rivkin, Hanushek, and Kain (2005) found that teachers affect test scores, not through education and experience, but through their unobservable characteristics. They found this by using test scores from a panel data set constructed by the Texas Schools Project. These data contained administrative records on students and teachers collected by the Texas Education Agency from the 1989-90 school year through

[1]For a recent survey of the effects of education inputs see Barrow and Rouse (2005). Krueger (1999) found that smaller class sizes increase student test scores by 4 percentile points and that teachers and teaching aides only slightly affect test scores. Krueger's paper is based on the STAR project which randomly assigned 11,600 students, teachers, and teaching aides to different size classes from kindergarten through third grade in Tennessee.

2001-2002. The authors focused on students and teachers in grades 4 through 8 for the school years 1995-1996 to 2000-2001, which gave them approximately 215,000 observations. By differencing across years and classrooms they identified the effect of teachers' unobservable characteristics on test scores. Fryer and Levitt (2004) found a smaller black-white test score gap than what others have estimated. These authors used the 1998/99 Early Childhood Longitudinal Survey, which has a large body of information about a student's home and household characteristics, and which I use in this paper. They attributed the smaller estimate to the large number of home environment control variables that they included.

In the economics literature, research on parent volunteers is nonexistent. Sociologists and education researchers of parent involvement have found both small and large, and positive and negative returns to volunteering (for a summary of this literature see Henderson and Mapp, 2002). Economists' research on volunteering suggests that benefits to volunteers in the paid labor market are shortened unemployment spells (Day and Devlin, 1998, 1996; Chen, 2004) and acquired human capital (Zimmerman, 2004).

I find that classroom parent volunteers significantly increase their child's reading test scores. After instrumenting for the endogeneity of volunteering, I find a 12 percentile increase in reading test scores for students whose parents volunteer in the classroom. Without instrumenting for the endogeneity of volunteering, I find a 2.5 percentile increase in reading test scores for first graders. Boys and students in poorly-behaved classrooms benefit more from their parents' volunteering than do other students. Boys whose parents volunteer gain 15 percentiles in reading and students in poorly-behaved classrooms gain 13 percentiles. An additional return to volunteering is gains in teacher as-

sessments. Teachers assess children of parent volunteers 10 percentiles higher than children with comparable standardized test scores. Not only do children of parent volunteers learn more, but they also take home higher scores on their report cards.[2]

These results suggest that more effort should be spent on increasing the use of volunteers in schools, which may be opposed by administrators and teachers if volunteers are perceived as "snoopers" or "watch-dogs" (Keates, September 2, 2005). Since volunteers are by definition those who work without pay, increasing the number volunteers is not as easy as increasing the number of books in a classroom or increasing a teacher's salary. Another implication is the importance of home-based inputs versus school-based inputs in the education production function. From considering changes in homeschooling and boarding school rates, it appears that some households have already come to this conclusion. The number of households involved in the extreme version of volunteering–homeschooling–increased by about 30 percent, from 0.85 million to about 1.1 million students between 1999 and 2003 (Princiotta and Bielick, 2006).[3] About the same time, between 2001 and 2004, the enrollment at boarding schools–the other extreme, absolutely no parent volunteering–decreased about 7 percent, from 40,694 to 37,775 students (National Association of Independent Schools, 2002, 2004).

[2] Ancedotal evidence also suggests that volunteering has a large impact on education outcomes. Principal David Banks of an all-boy public high school in New York city paired almost all of his 180 students with mentors. The impact has been, "beyond profound" (Tyre, 2006).

Michael Gurin of the Gurian Institute notes that, "an older man [volunteer] reminds a boy in a million different ways that school is crucial to their mission in life" (Tyre, 2006, pg. 51).

[3] The most common reasons for homeschooling are concerns about the school environment (31 percent) and to provide religious and moral instruction (30 percent).

Next I describe the data and then present the first empirical model. In Sections 3.4 and 3.5 I discuss the estimates of the returns to volunteering and concluding remarks are in Section 3.6.

3.2 Early Childhood Longitudinal Study

The data set I use to measure the educational productivity of volunteers is the kindergarten and first grade waves of the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K).[4] The National Center for Educational Statistics (NCES) of the U.S. Department of Education directed the collection of these data. To identify kindergartners to participate in the study, the NCES randomly selected 100 counties or groups of counties. The probability of a particular county being chosen is proportional to the number of 5-year-olds. They selected schools with kindergarten programs by a similar weighting scheme. In total, the NCES sampled 1,280 schools and about 23 students in each of these schools for a total of 21,260 kindergartners.[5] They collected data from and about teachers, administrators, parents, and students twice in the kindergarten year (fall 1998 and spring 1999) and twice in the first grade (fall 1999 and spring 2000).

Elementary school data are ideal for observing the effect of volunteering on test scores. Volunteering rates are higher in elementary schools than in intermediate or high schools. The ability to identify the effects of volunteer inputs in the school or classroom decreases as students obtain more education (Singh, Bickley, Trivette, Keith, Keith, and Anderson, 1995).

[4] For more information about these data see National Center for Education Statistics (2004).

[5] The NCES over sampled Asian children and private school kindergartners.

I restrict the sample to students who attend a public school, are not involved in a special education program, and do not move during the school year. Because volunteering for a religious organization is the most common type of formal volunteering, volunteers at a parochial school may choose to volunteer for religious reasons rather than to increase their child's test scores.[6] Parents of special education children often have more influence in school decisions, such as student-teacher matching, than parents of non-special education children. Special education programs also often have unusually small class rooms, more resources, and lower test scores.

In each sampling wave, trained survey administrators conducted a one-on-one assessment with each student. These assessments lasted for approximately 50-70 minutes. The first grade cognitive assessment section covered three areas: reading, mathematics, and science.[7] The administrator screened each child about her knowledge of English. If the child did not pass the English screening test and spoke Spanish then the administrator gave the test in Spanish. In the first stage of each assessment section was a routing component of 12 to 20 questions spanning a range of difficultly. Based on the results from the first stage, the child proceeded to a second stage of low, middle, or high difficulty. The NCES then converted these assessment scores into Item Response Theory (IRT) scores. An IRT score is an estimate of how the child would have performed if she had answered each question in each level of difficulty. The IRT scores also control for guessing, level of difficulty, and how well a question discriminates among student abilities.

[6]Individuals who volunteer for a religious organization have systematically different volunteering behavior than individuals who volunteer for other types of organizations (Musick, Wilson, and Junior, 2000).

[7]The three areas in the kindergarten year are language and literacy, mathematical thinking, and general knowledge.

The NCES asked principals, teachers, and parents about volunteer activities. Teachers reported if a child's parent volunteered in the classroom or school during the school year and the percentage of children in the classroom whose parents regularly volunteered. With regards to the classroom as a whole, teachers also reported average weekly volunteer hours, instructional volunteer hours, and non-instructional volunteer hours. School administrators, like teachers, also reported the percentage of children whose parents regularly volunteered in the school. An adult in the household reported information about the household's volunteer participation. Survey questions about volunteering differentiated volunteering from other forms of school involvement, such as participation at an open house, parent teacher organization meeting, parent-teacher conference, school event, class event, or fund-raising event.

Teachers and households reported similar parent volunteering rates, 46 and 49 percent, respectively. The variable *Parent Volunteer (Household Reported)* equals 1 if the answer to, "Since the beginning of this school year have you or the other adults in your household volunteered at the school or served on a committee?" is yes and 0 if no. The variable *Parent Volunteer (Teacher Reported)* equals 1 if the answer to, "During this school year, have this child's parents/guardians volunteered to help in your classroom or school?" is yes and 0 if no.

About 25 percent of teachers' responses about volunteering are not consistent with households' responses. Members of the household who respond to the survey might not recall if they or other household members volunteered during the school year. Another explanation may be that parents who volunteer outside of the classroom are unobserved by the teacher. The latter explanation strengthens the assumption that teacher reported parent volun-

teer statust data identify classroom volunteers and not volunteers in other parts of the school. Evidence of the nonrandom selection of volunteers previously described is present in both teacher and household measures of parent volunteer status.

Families who volunteer are different than families who do not volunteer in the classroom. Households that volunteer have more education, more prestigious jobs, and are more likely to have a non-working mother.[8] Not only do the characteristics of volunteers differ but the activities that they do with their child at home also differ. Volunteer households on average have more children's books at home, read to their child more, tell their child more stories, and on average parent volunteers are more likely to be seen with their child at a library or museum than other children's parents.[9]

In unconditional means, children of parent volunteers have higher test scores than other children. Reading test scores of children of classroom parent volunteers on average are 18 percentiles higher than other children. In mathematics, children of volunteers are 23 percentiles higher than other children. These trends persist throughout all grades and all semesters.

Do parents volunteer because their child is struggling at school? Children who have high test scores going into first grade are more likely to have a parent who volunteers (see Table 3.1). The headings on each Column, 1,..., 5, represent the spring kindergarten reading score quintle. Those in Column

[8]WIC and Food Stamp participation is extremely high for both volunteer and non-volunteer households. This is because many respondents for a households did not know if they participated in WIC or Food Stamp programs. These were coded as missing and I account for this in each of the models to follow by including an indicator variable for both missing WIC and missing Food Stamps information.

[9]Eighty-eight percent of volunteers and 71 percent of non-volunteers attend an open house duringthe first grade school year.

Table 3.1: Volunteering Rates by Reading Spring Kindergarten Scores and Socioeconomic Measure

Socioeconomic Quintiles	Reading Score Quintiles 1	2	3	4	5	All
1	0.16	0.23	0.29	0.27	0.24	0.22
2	0.26	0.36	0.39	0.48	0.50	0.37
3	0.34	0.41	0.48	0.55	0.56	0.47
4	0.46	0.51	0.59	0.63	0.70	0.59
5	0.63	0.63	0.69	0.76	0.81	0.74
All	0.28	0.39	0.48	0.57	0.65	

Note: Numbers in cells are volunteering percentages. For example, the upper left hand cell is a volunteering rating of 16 percent.

1 are at the bottom of the class and those in Column 5 are at the top of the class. The rows are similarly defined but for socioeconomic status (SES). The volunteering rate of parents whose children are at the bottom of the class at the end of the kindergarten year is 28 percent. In contrast, the volunteering rate of parents whose children are at the top of the class is 65 percent. Similarly, 22 percent of parents at the bottom of the SES measure volunteer and 74 percent of those in the top SES cell volunteer. Children that are doing well are positively correlated with parent volunteerism.

3.3 Empirical Model

I follow the standard empirical model in the literature to estimate the effect of volunteer inputs on test scores (Fryer and Levitt, 2004; Barrow and Rouse,

2005):

$$E_{t,i} = \delta_0 + \delta_1 v_{t,i} + \boldsymbol{\beta}\mathbf{x}_{t,i} + \beta_E E_{t-1,i} + \varepsilon_{t,i}, \tag{3.1}$$

$$E(\varepsilon) = 0, cov(\mathbf{w}, \varepsilon) = 0, cov(v, \varepsilon) = 0 \tag{3.2}$$

where i indexes students in the first grade school year. A student's final first grade test score is represented by $E_{t,i}$, a student's final kindergarten test score or beginning first grade test score is $E_{t-1,i}, \mathbf{x}$ is a vector of control variables that may be reported either in time t or in time $t-1$, v is a measure of volunteering, ε is a random error term, and $\mathbf{w}$ is a vector of all of the right hand side variables except for v. The coefficients represent point changes in final first grade scores. As a measure of educational outcome, E, I use reading and math test scores but also experiment with reading and math teacher assessment scores. For a measure of volunteering, I use a dichotomous parent volunteer participation variable as reported by teachers. I also experiment with six other measures of volunteering. In the following Sections, I estimate the coefficient on volunteering with Weighted Least Squares, Ordinary Least Squares, and semi-parametrically. In Section 3.5, I relax the assumption on $cov(v, \varepsilon) = 0$ and estimate δ_1 with an instrumental variables approach.

The above model could also have been written with first differences of the test scores on the left hand side,

$$E_{t,i} - E_{t-1,i} = \alpha_0 + \alpha_1 v_{t,i} + \boldsymbol{\Gamma}\mathbf{x}_{t,i} + \upsilon_{t,i}, \tag{3.3}$$

where $E_{t,i} - E_{t-1,i}$ is the test score gains during the first grade year and the coefficients represent point changes in test score gains. The estimated coefficients on this model are nearly identical to those in equation 3.1; however, the

coefficients in equation 3.1 are easier to interpret: point gains on the final first grade scores.

The error term, ε, is heteroskedastic. Classes in small schools have more students sampled per class than classes in large schools because the target number of students sampled at any one school is 24, regardless of school size. The average first grade class size is 21 students and the average number of students sampled in a class is 4 students. To correct the standard errors, I allow for terms in the variance-covariance matrix to differ by each classroom.

Most of the explanatory variables in equation 3.1 are endogenous. My focus is to determine a cause and effect relationship between volunteering and test scores and not necessarily a cause and effect relationship for other variables in the model. The coefficients on the variables in $\mathbf{x}$ should be interpreted as correlations and not necessarily causations. For example, teaching aides are negatively correlated with test scores (see Table 3.2). The average in Row 1, Column 2, 71.23, represents the average reading score for students in classrooms with no regular parent volunteers, but their parent volunteered at least once during the year, and one teaching aide is assigned to the class. The next average in Row 1, Column 4, 65.44, is the average score for a similar student, but two teaching aides are assigned to their class instead of one.d This may incorrectly suggest that adding a teaching aide to a classroom decreases average test scores, whereas an additional teaching aide may be assigned to classrooms with low scores.[10]

[10] See Lazear's (2001) model for optimal class size with well- and poorly-behaved students, which characterizes this type of correlation.

Table 3.2: Average Reading Spring First Grade Scores by Percent of Parents that Regularly Volunteer, Number of Paid Teaching Aides, and Parent Volunteer Status

Percent of Parents that Regularly Volunteer in the Classroom		Number of Paid Aides for Classroom and Parent Volunteer Status													
		0		1		2		3		4		5		6	
		Parent Volunteers													
		No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
None	*Mean*	61.63	71.23	61.72	65.44	53.45	57.50	65.67	71.09	63.10	--	--	--	53.89	81.89
	Std. Err.	0.85	1.24	0.68	1.38	1.82	5.73	2.96	9.28	2.72				10.43	14.92
	N	405	144	522	158	55	13	13	2	7				2	3
1-25 percent		64.54	73.46	64.93	73.03	63.16	71.81	62.50	72.79	62.40	67.33	--	88.98	--	--
		0.56	0.63	0.50	0.61	1.19	1.34	2.00	3.17	4.91	8.38		--		
		1048	920	1284	965	228	175	55	28	11	5		1		
26-50 percent		68.49	76.27	65.37	76.54	62.81	71.55	86.70	89.21	48.56	83.51	--		--	--
		1.70	1.11	1.36	1.21	3.61	2.82	8.54	5.64	8.43	6.22				
		128	269	196	268	28	47	4	13	3	3				
51-75 percent		76.57	82.26	66.35	80.80	64.12	76.72	63.25	78.89	81.10	--	--		--	--
		2.81	1.37	2.78	1.62	3.05	3.20	4.95	3.69	--					
		53	180	45	142	15	40	5	12	1					
76-100 percent		70.50	83.43	68.62	77.63	65.02	78.01	--	--	--	--	--	--	--	--
		5.14	2.14	5.55	2.00	4.89	5.88								
		22	92	13	81	3	10								

Note: Data are weighted by the Spring K - Spring 1st Grade weights.

3.4 Return to Volunteering Estimates

The reading test score return to volunteering is large. First I begin with a naive estimator, WLS, and sensitivity analyses. Next, I consider a non-parametric estimator of the return to average weekly number of volunteer hours. Following that, I consider other measures of volunteering and another measure of education output, teacher assessment scores. In the next Section, Section 3.5, I model for the endogeneity of volunteering with a General Method of Moments (GMM) estimator. All of these estimates, both in this Section and in Section 4, suggest that classroom parent volunteers increase reading test scores.

As suggested by the summary statistics, the return to volunteering with no control variables is a 16 percentile increase or a 10 point increase in spring reading test scores for a student at the middle of the test score distribution (see Table 3.3, Column 1).[11] Much of this gain, however, is due to students' exit test scores from kindergarten (see Column 2). Children of parent volunteers begin the first grade with higher test scores than other children. In Column 3, I include controls for the number of other volunteers in the classroom and school.[12] In this column the return to volunteering is a 6 percentile increase in reading test scores. In Column 5, I include a full set of control variables, which includes all of the control variables also used by Fryer and Levitt (2004).[13]

[11] In reporting other results, I assume that the student is at the middle of the test score distribution.

[12] The first variable, *1% to 25% of Classroom Parents Volunteer,* equals 1 if the percentage of regular parent volunteers is between 1 and 25 percent, and 0 otherwise. The next variable, *26% to 100% of Classroom Parents Volunteer*, equals 1 if the percentage of regular parent volunteers is between 26 and 100 percent, and 0 otherwise. The omitted group is *0% of Classroom Parents Volunteer*. The other variables, *1% to 25% of School Parents Volunteer* and *26% to 100% of School Parents Volunteer,* are similarly defined.

[13] For a list of the full set of control variables, see the Appendix, Volunteering section.

With these data Fryer and Levitt found a significantly smaller estimate of the black-white test score gap than others have found in the literature. They attributed this to the large number of home environment control variables that they included.[14] In this column, the return to volunteering is a 2 percentile increase. In the following analyses, I use the specification in Column 4, which is based on a smaller set of control variables that yields similar estimates.[15] The return to volunteering in Column 4 is a 2.5 percentile increase.

[14] Indeed, one of their control variables is parent volunteer status.

[15] The small set of control variables includes: Asian, Black, Socioeconomic Status Score, Female, Parent Read to Child Every Day, Teacher Hours of Paid Preparation Time, Individual Tutoring in Reading, Title 1 Reading Program Participation, Individual Tutoring in Mathematics, and Title 1 Mathematics Program Participation.

Table 3.3: Estimated Reading Return to Volunteering of First Graders

		Reading (Mean=69.26, Std. Err.=0.790)				
Covariates	Mean	(1)	(2)	(3)	(4)	(5)
Parent Volunteer	0.469	10.130	3.381	2.922	1.576	1.143
	(0.005)	(0.530)	(0.388)	(0.396)	(0.395)	(0.381)
Spring Kindergarten Test Score	38.758		1.123	1.113	1.027	0.981
	(0.442)		(0.019)	(0.019)	(0.019)	(0.018)
Days Since Spring Testing	365.202		0.063	0.063	0.067	0.068
	(4.165)		(0.010)	(0.010)	(0.010)	(0.009)
1% to 25% of Classroom Parents Volunteer	0.625			1.174	0.573	0.464
	(0.007)			(0.553)	(0.548)	(0.532)
26% to 100% of Classroom Parents Volunteer	0.212			1.693	0.543	0.097
	(0.002)			(0.679)	(0.665)	(0.682)
1% to 25% of School Parents Volunteer	0.557			2.037	1.636	1.260
	(0.006)			(3.240)	(3.333)	(3.626)
26% to 100% of School Parents Volunteer	0.285			3.972	3.377	2.589
	(0.003)			(3.297)	(3.404)	(3.675)
Small Set of Controls		N	N	N	Y	Y
Full Set of Controls		N	N	N	N	Y
R squared	--	0.070	0.575	0.578	0.600	0.626
Number of Observations	7,689	7,689	7,689	7,689	7,689	7,689

Note: The unit of observation is a student. Non-Hispanic whites are the omitted race category. Test scores are IRT test scores. Indicator variables for missing variables and a constant term are included in the regressions. Estimation is done using weighted least squares with the sample weights provided by the ECLS. Robust and classroom clustered standard errors are given in the parentheses. The full set of controls includes over 100 additional covariates on household, family, teacher, school, and student characteristics.

Based on an estimator that assumes that volunteering is exogenous, the return to volunteering is small, but not relatively small. The return to reducing class sizes from 22 to 15 students is a 6 percent increase in test scores (Krueger, 2003). Thus, the return to reducing class sizes by 30 percent is the same return to a parent volunteering in the classroom at least once during the school year. Considering the cost of both policies, the net return to parent volunteers is at least comparable, if not greater, than reducing class sizes.

The effect of parent volunteering on math test scores differs from the effect on reading test scores. The initial estimate of the math test score return to parent volunteering is a 20 percentile increase in math test scores (see Table 3.4, Column 1). However, after adding more control variables the return reduces to a 1 percentile increase (see Column 5).[16] Why do the returns differ for mathematics and reading? The answer may simply be that, "First grade is traditionally thought of as the level where children learn to read" (PBS, 2006).

[16]I use the specification in Column 4 for further analyses. The return in Column 4 is a 1.5 percentile increase in math test scores.

Table 3.4: Estimated Math Return to Volunteering of First Graders

		Math (Mean = 55.375, Std. Err. = 0.790)				
Covariates	Mean	(1)	(2)	(3)	(4)	(5)
Parent Volunteer	0.462	7.599	1.736	1.439	0.568	0.199
	(0.005)	(0.407)	(0.281)	(0.292)	(0.287)	(0.296)
Spring Kindergarten Test Score	31.499		1.030	1.021	0.949	0.932
	(0.352)		(0.015)	(0.015)	(0.016)	(0.016)
Days Since Spring Testing	365.257		0.050	0.050	0.050	0.052
	(4.076)		(0.007)	(0.007)	(0.007)	(0.007)
1% to 25% of Classroom Parents Volunteer	0.625			0.939	0.458	0.313
	(0.007)			(0.372)	(0.362)	(0.356)
26% to 100% of Classroom Parents Volunteer	0.206			1.505	0.577	0.110
	(0.002)			(0.482)	(0.473)	(0.487)
1% to 25% of School Parents Volunteer	0.560			-0.128	-0.780	-0.942
	(0.006)			(2.170)	(2.342)	(2.034)
26% to 100% of School Parents Volunteer	0.277			0.684	-0.280	-0.675
	(0.003)			(2.190)	(2.363)	(2.054)
Small Set of Controls		N	N	N	Y	Y
Full Set of Controls		N	N	N	N	Y
R squared	--	0.064	0.584	0.586	0.604	0.615
Number of Observations	8,030	8,030	8,030	8,030	8,030	8,030

Note: The unit of observation is a student. Non-Hispanic whites are the omitted race category. Test scores are IRT test scores. Indicator variables for missing variables and a constant term are included in the regressions. Estimation is done using weighted least squares with the sample weights provided by the ECLS. Robust and classroom clustered standard errors are given in the parentheses. The full set of controls includes over 100 additional covariates on household, family, teacher, school, and student characteristics.

In general, the effect of classroom parent volunteers on other children in the class is smaller than the effect of volunteering on their own children; however, none of the spillover variables are statistically significant (see Columns 4 and 5 in both Tables 3.3 and 3.4). Another test for spillover effects is to regress equation 3.1 separately on the samples of i) students in classrooms with no regular parent volunteers, ii) students in classrooms with 1-25 percent regular parent volunteers, and iii) students in classrooms with 26-100 percent regular parent volunteers (see Table 3.5, Row "By Other Parent Volunteers in the Classroom"). These estimates, which are identical to interacting equation 3.1 with n indicator variable for each sample, differ in magnitude, but not in a statistically significant way.

These results are not alarming. Studies based on the randomly assigned student, teacher, and teaching aide project, the STAR project, found that teaching aides do not have a significant effect on test scores (Finn and Achilles, 1990; Word, Johnston, and Bain, 1990; Krueger, 1999). In the worst case, parent volunteers appear to the other students in the classroom as an additional teaching aide and hence do not affect test scores. Another reason why these variables are insignificant may be because of measurement error. Teachers are asked to identify if each child's parent volunteers and what percent of other parents in the classroom regularly volunteer: none, 1-25 percent, 26-50 percent, 51-75 percent, and 76-100 percent. Because only 5 students on average are sampled in each class, the information on the number of other parents who volunteer is less accurate than the information on a parent's volunteer status. These results do not suggest that there are no spillover effects, but rather they do not provide evidence for the contrary.

Though parents volunteer at the same rate for sons and daughters, the

Table 3.5: Sensitivity Analyses on the Return to Volunteering

Specification	Coefficient on Volunteer Status			
	Reading		Math	
Baseline	1.576	(0.395)	0.568	(0.287)
Unweighted	1.598	(0.322)	0.701	(0.251)
By Paid Teaching Aides				
None	1.728	(0.610)	0.613	(0.441)
One	1.671	(0.573)	0.406	(0.409)
More than One	1.408	(1.207)	0.257	(1.002)
By Other Parent Volunteers in the Classroom				
None	1.651	(0.850)	0.398	(0.683)
1-25% of Parents	1.440	(0.497)	0.286	(0.343)
26-100 % of Parents	2.092	(0.858)	1.475	(0.682)
By Other Parent Volunteers in the School				
None	--	--	--	--
1-25% of Parents	0.807	(0.488)	0.398	(0.364)
26-100 % of Parents	3.660	(0.816)	1.658	(0.571)
By Gender				
Males	2.271	(0.558)	0.924	(0.401)
Females	0.989	(0.562)	0.317	(0.398)
By Base Score				
Lower half	0.954	(0.528)	0.424	(0.393)
Upper half	1.803	(0.548)	0.764	(0.400)
By SES quintiles				
Bottom	-1.223	(1.020)	-0.729	(0.636)
Second	2.246	(0.845)	0.812	(0.618)
Third	1.589	(0.845)	1.336	(0.655)
Fourth	1.666	(0.764)	0.766	(0.576)
Top	1.207	(0.846)	-0.068	(0.729)

Note: Cells are blank if there are less than 100 observations. Standard errors are in parentheses. Also included in each regression are indicator variables for the percent of regular classroom parent volunteers, regular school parent volunteers, and a constant term.

effect on test scores differs by gender of the student (see Table 3.5, Row "By Gender"). The test score return for boys is an increase by 4 percentiles and for girls an increase by 1.5 percentiles.[17] The estimates in Table 3.5 are from estimating equation 3.1 on the sub-sample specified in the left hand column. These estimates show variation in the effectiveness of parent volunteering and that the effects of volunteering are generally positive. For most of the estimates in the Reading column the estimates are also statistically significant.

In addition to the measures presented above, there are four other measures on classroom parent volunteering in the data. I substitute each of these variables for *Parent Volunteer* as reported by the teacher and report the results on reading test scores in Table 3.6. The coefficient in Column 1 is the same as the coefficient in the first row of Table 3.3, Column 4. The next row in the table is *Parent Volunteer* as reported by the parent.

[17] Lazear (2001) suggested that in a classroom education model where disruption (or lack thereof) is a public good that the optimal class size for better-behaved students is larger than the optimal class size for poorly-behaved students . If boys are more disruptive than girls then the presence or threat of the presence of a parent volunteer may have a larger impact on boys than girls because boys are positively correlated with poorly-behaved students.

Table 3.6: Reading Test Score Return to Various Volunteering Measures

Volunteer Measure	Mean	(1)	(2)	(3)	(4)	(5)	(6)
Parent Volunteer (Teacher Reported)	0.47	1.570					
		(0.395)					
Parent Volunteer (Household Reported)	0.50		1.009				
			(0.415)				
Classroom Volunteer Hours	2.97			0.096	0.317		
				(0.051)	(0.103)		
Classroom Volunteer Hours Squared	29.86				-0.011		
					(0.004)		
Instructional Volunteer Hours	3.65					0.090	0.340
						(0.076)	(0.152)
Instructional Volunteer Hours Squared	29.78						-0.169
							(0.206)
Non-Instructional Volunteer Hours	1.29					-0.016	-0.013
						(0.114)	(0.006)
Non-Instructional Volunteer Hours Squared	8.04						0.009
							(0.010)
Small Set of Controls		Y	Y	Y	Y	Y	Y
R squared		0.600	0.593	0.597	0.598	0.585	0.586
N		7,689	6,908	7,530	7,530	4,291	4,291

Note: See notes on previous table.

The question asked to parents about volunteering is different than the question about volunteering asked to teachers. Parents are asked:

> Since the beginning of this school year have you or the other adults in your household ... volunteered at the school or served on a committee?

Parent Volunteer as reported by parents identifies volunteering for the school, not necessarily volunteering in the classroom. Teachers, on the other hand, were asked:

> During this school year, have this child's parents/guardians ... volunteered to help in your classroom or school?

The question asked to teachers is more likely to identify classroom volunteering than the question asked to parents. Teachers are more likely to see and report classroom parent volunteers than parent who are volunteering in other areas of the school. The return to volunteering by the parent reported measure is smaller than the teacher reported measure because the parent measure contains less precise information about classroom volunteering.

The return to volunteering with other measures of parent volunteering, average weekly volunteer hours, instructional volunteer hours, and non-instructional hours, are also smaller than the teacher reported *Parent Volunteer* variable. These measure are also too general to identify the effect of parent volunteering on test scores.

3.4.1 Nonparametric Return to Volunteering Hours

Hanushek (2004) suggested that "existing modelling suggests no clear rela-

tionship between resources and student performance" and that "a possible explanation is that the achievement process is a complicated interactive one such that simple linear additive formulations break down." With a large number of observations and a continuous measure of volunteerism, average weekly volunteer hours, I estimate the return to volunteer hours semi-parametrically. The semi-parametric estimate suggests that volunteer hours are slightly non-linear and that they have a typical labor productivity profile (see Figure 3.1).

I use a penalized spline estimator to estimate the return to average weekly volunteer hours. A penalized spline is a spline regression that weights each spline. The three choice parameters are the smoothing parameter, the knot locations, and the number of knots. A criterion for choosing the smoothing parameter is to minimize the Mean Square Error (MSE). I minimize the MSE by the restricted maximum likelihood method.[18] I follow Ruppert, Wand, and Carroll (2003, pg. 126) who suggested choosing the knot location κ_k for knot k, for $k = 1...K$, by

$$\kappa_k = \left(\frac{k+1}{\kappa+2}\right) \text{th sample quantile of the unique } x_i. \tag{3.4}$$

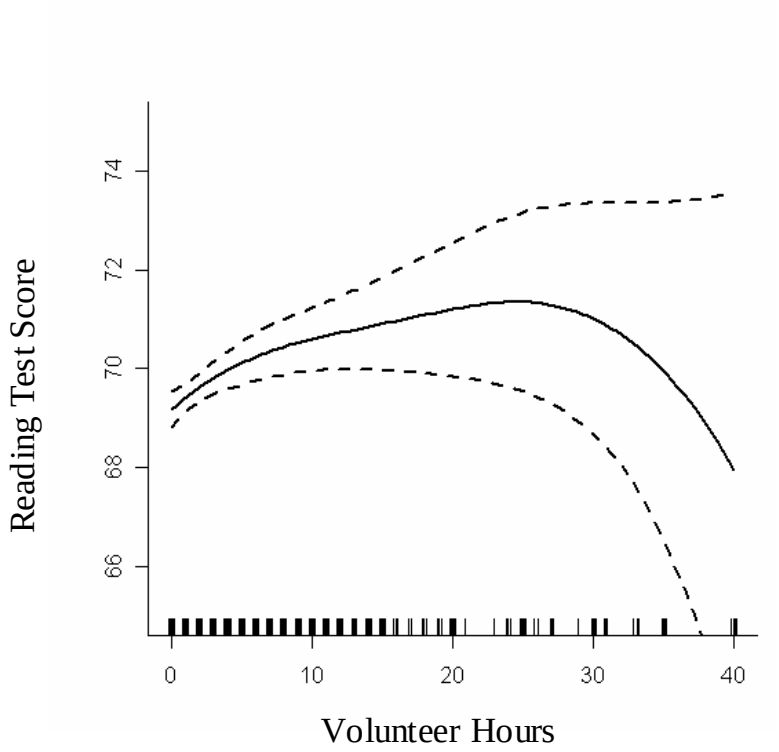
For a choice of K they suggested using

$$K = \min\left(\frac{1}{4} \times \text{number of unique } x_i, 35\right).^{19} \tag{3.5}$$

The solid line in Figure 3.1 is the semi-parametric estimate of the return to volunteer hours. The dotted bands around the estimate are standard error

[18] Cross-validation (CV) and restricted maximum likelihood (REML) are two methods for minimizing the MSE. The REML method weights the bias and the variance in the MSE criterion slightly differently than the CV method but obtains the same MSE value.

Figure 3.1: Semi-parametric Estimate of the Return to Average Weekly Volunteer Hours on Reading Test Scores



Note: The dotted lines are deviations of ± 2 standard errors.

bands of ±2 standard deviations which is roughly a 95 percent confidence band.[20] The tick marks at the bottom of the graph represent the location of the data. The paucity of tick marks beyond 20 volunteer hours means that there are relatively few observations of more than 20 volunteer hours. After 25 volunteer hours the standard error bands widen and the curve slopes downward precipitously.

3.4.2 Teacher Assessment Return to Volunteering

Students take home report cards, not standardized tests.[21] If teacher assessments are not completely objective then teachers may thank volunteers for helping in their classroom by giving higher grades to their children.[22] To test this hypothesis, I regress teacher assessment scores (TE) on the variable *Parent Volunteer,* the full set of control variables, and the gains in standardized test scores:

$$TE_{t,i} = \delta_0 + \delta_1 v_{t,i} + \boldsymbol{\beta}\mathbf{x}_i + \beta_{E_t} E_{t,i} + \beta_{E_{t-1}} E_{t-1,i} + \varepsilon_{t,i} \tag{3.6}$$

[20] Strictly speaking these are not confidence bands, but in practice they are close approximations.

[21] Some parents may actually value report card scores more than standardized test scores. Jacob and Lefgren (2005) found that on average "parents strongly prefer teachers that principals describe as good at promoting student satisfaction and place relatively less value on a teacher's ability to raise standardized math or reading achievement." Jacob and Lefgren also found that parents in lower-income schools value standardized test scores more than parents in higher-income schools.

[22] Rather than thanking volunteers for volunteering, another hypothesis with a similar conculsion is that teachers give higher grades to children of volunteers in order to insulate themselves from aggressive parents (Gibbs, Bower, August, Berryman, Thomas, Healy, Kauffman, McDowell, and Rubiner, 2005).

The name of the child is another source of teacher assessment bias. Figlio (2005) showed that among children from the same family teachers give lower grades to children with a name that is associated with a lower socioeconomic status. If the name of a child influences teacher assessments then an active parent volunteer is also likely to influence teacher assessments.

$$E(\varepsilon) = 0, cov(\mathbf{w}, \varepsilon) = 0, cov(v, \varepsilon) = 0 \tag{3.7}$$

As in equation 3.1, the exit standardized test score is denoted by $E_{t,i}$, the entry standardized test score is denoted by $E_{t-1,i}$, and $\mathbf{w}$ is a vector of all of the right hand side variables except for v.[23]

Teachers systematically give children of parent volunteers higher assessments than children of parents who do not volunteer. In reading, teachers assess children of volunteers 0.121 points higher than other students. In math, teachers assess children of volunteers 0.127 points higher than other students. In both reading and math, teachers assess children of volunteers about 5 percentiles higher than other children in the classroom.[24]

3.5 Instrumented Return to Volunteering Estimates

The variable *Parent Volunteer* is clearly endogenous. To recognize this in the model, assume that volunteering is determined by an missing variable, q (Wooldridge, 2002, Chp. 5). The model expressed in equation 3.1 then

[23] Teachers assess their students on a scale from 1 to 5, with 5 being the highest score. The survey question to teachers is, "Overall, how would you rate this child's academic skills in each of the following areas, compared to other children of the same grade level? Far below average = 1, Below average = 2, Average = 3, Above average = 4, Far above average = 5." Teachers rate both reading and math skills. The NCES then converted these scores into continuous Rasch Scores. "The Rasch Rating Scale model uses the pattern of ratings on the items to determine an estimate of the difficulty of each item and to place each student on a continuous ability scale (in this case 1-5)" (National Center for Education Statistics, 2002, pg. 3-19).

[24] I also experiment by including controls for other parent volunteers. Coefficients on these variables are small in magnitude and they do not affect the coefficients on other variables.

becomes

$$E_{t,i} = \delta_0 + \delta_1 v_{t,i} + \boldsymbol{\beta}\mathbf{x}_{t,i} + \beta_E E_{t-1,i} + \lambda q_{t,i} + u_{t,i}. \tag{3.8}$$

This implies that $cov(v, \varepsilon) = cov(v, q) \neq 0$ and that the estimated coefficient on the variable *Parent Volunteer* is biased. This expression for the bias is

$$plim\hat{\delta}_1 = \delta_1 + \lambda \left[\frac{cov\,(v, q)}{var\,(v)} \right] \tag{3.9}$$

where $\hat{\delta}_1$ is the OLS estimator and δ_1 is the true value of the parameter.

Ex ante, the bias may be either positive or negative. The stereotype about parents who volunteer is that they are also the type of parents who work with and encourage their child at home. Thus, any effect of volunteering on test scores is attributed to unobservable home environment variables such as encouragement and education expectations and not from volunteering in the classroom. This case is an example of a positive bias, $cov\,(v, q) > 0$ and $\lambda > 0$. Lazear's model, however, suggests that parents volunteer because of their child's poor behavior at school and thus $cov\,(v, q) < 0$ and $\lambda > 0$ (Lazear, 2001). In both of these cases, q is a measure parental interest in their child's education outcome.

To correct for this bias, I use an instrumental variable approach to estimate the coefficient on the variable *Parent Volunteer*. The first and second stages of the model are respectively

$$v_{t,i} = \gamma_0 + \boldsymbol{\alpha}\mathbf{x}_{t,i} + \boldsymbol{\theta}\mathbf{z}_{t,i} + \xi_{t,i}, \tag{3.10}$$

$$E_{t,i} = \delta_0 + \delta_1 v_{t,i} + \boldsymbol{\beta}\mathbf{x}_{t,i} + \beta_E E_{t-1,i} + \varepsilon_{t,i}. \tag{3.11}$$

The conditions for a consistent estimator of δ_1 are:

$$cov(\mathbf{z}, \varepsilon) = \mathbf{0} \text{ and } \boldsymbol{\theta} \neq 0. \tag{3.12}$$

I estimate δ_1 with a GMM estimator with a 1 step optimal weighting matrix and use the instruments and variables: $\mathbf{z}_{t,i}$, $\mathbf{x}_{t,i}$, $E_{t-1,i}$, and $\varepsilon_{t,i}$, to construct the moment conditions (Wooldridge, 2002, Chp. 8).

Embarking on the "instrument road can be perilous. The challenge is to find or construct variables that are conditionally correlated with volunteering but are not correlated with test scores.[25] Three variables that satisfy the above conditions are: "The number of times you have breakfast with your child during a week," "The number of people over the age of 18 in the household," "Did you participate in school fundraising activities last year," and the interaction of these variables.

The instrumented reading test score return to volunteering is a 12.5 percentile increase (see Table 3.7). An F-test on the first stage that the instrumental variables are jointly equal to 0, $H_0 : \theta = 0$, is strongly rejected. With more than one instrument, I can also test with the Hansen's J test statistic for the condition: $cov(\mathbf{z}, \varepsilon) \neq \mathbf{0}$. I can not reject this hypothesis, which suggests but is not evidence that the instruments are uncorrelated with the error term in the 2nd stage.

[25] An often used instrument for the choice of the level of education is the distance from home to school (Card, 1995, 1999). This turns out to be a weak instrument for volunteering status.

Table 3.7: Instrumented Test Score Return to Volunteering of 1st Graders

	Reading		Mathematics	
	1st Stage	2nd Stage	1st Stage	2nd Stage
Covariates	Volunteer Status	Test Score	Volunteer Status	Test Score
Parent Volunteer	--	6.801	--	2.355
	--	(2.566)	--	(2.019)
Spring Kindergarten Test Score	0.004	0.987	0.004	0.947
	(0.000)	(0.019)	(0.001)	(0.016)
Days Since Spring Testing	0.001	0.0655	0.0006	0.053
	(0.000)	(0.009)	(0.000)	(0.006)
1% to 25% of Classroom Parents Volunteer	0.119	-0.116	0.118	0.2286
	(0.019)	(0.619)	(0.018)	(0.452)
26% to 100% of Classroom Parents Volunteer	0.249	-0.571	0.246	0.212
	(0.024)	(0.915)	(0.024)	(0.680)
1% to 25% of School Parents Volunteer	-0.006	0.253	-0.012	-0.164
	(0.018)	(0.543)	(0.018)	(0.364)
26% to 100% of Classroom Parents Volunteer	0.027	0.731	0.021	0.098
	(0.021)	(0.634)	(0.021)	(0.432)

Table 3.7 (Continued): Instrumented Test Score Return to Volunteering of 1st Graders

Instruments				
Number of Days Eat Breakfast with Parents	0.016	--	0.014	--
	(0.008)	--	(0.007)	--
Parent Participates in School Fundraisers	0.091	--	0.087	--
	(0.038)	--	(0.037)	--
Number of Household Member Over Age 18	0.040	--	0.038	--
	(0.017)	--	(0.016)	--
Over 18*Fundraiser	-0.016	--	-0.015	--
	(0.016)	--	(0.015)	--
Breakfast*Fundraiser	0.011	--	0.012	--
	(0.005)	--	(0.005)	--
Over 18*Breakfast	-0.006	--	-0.006	--
	(0.003)	--	(0.003)	--
H0: Instruments = 0; F(6,2716) Critical Value	18.270	--	18.216	--
P-value	0.000	--	0.000	--
Hansen's J Test Statistic for Overidentification	--	3.017	--	13.739
P-value	--	0.697	--	0.017
R squared	0.193	0.584	0.194	0.595
Number of Observations	6,883	6,883	7,170	7,170

Note: The critical value of the F-statistics that the instruments are jointly equal to zero. The unit of observation is a student. Non-Hispanic whites are the omitted race category. Test scores are IRT test scores. A constant term is included in each regression. Robust and classroom clustered standard errors are given in the parentheses. The null hypothesis of the test for overidentification is that the instruments are uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation. The small set of control variables are included in each regression.

Why is the bias negative? An extension of Lazear's model appears to explain the selection: parents volunteer because their child is misbehaving, and similarly, children who are misbehaving receive the greatest benefit from parent volunteers. However, the unconditional correlation between students' misbehavior and parents' volunteerism is negative. Another explanation, and

one that is shared among volunteer consultants, is that on average the parents who choose to volunteer are over-aggressive parents.[26] Karen Geiger, a kindergarten teacher quoted in a Wall Street Journal article on parent volunteers, may have put it best when she said,

> I've had colleagues complain that they feel more parents are coming in with motives that aren't always pure: They're in there to snoop or to control how their child is taught.[27]

The same groups that benefited more than others in the previous Section also benefit more than others with a GMM estimator (compare Tables 3.5 and 3.8). With a GMM estimator, boys gain 15 percentiles and girls gain 9 percentiles on reading test scores. Students who are in classes that are misbehaved gain more than students who are classes that are well behaved, given that their parent volunteers. Students in misbehaved classrooms, whose parents volunteer, gain 13 percentiles and students in well behaved classrooms, whose parents volunteer, gain 7 percentiles.

As I also did in the previous section, I use a GMM estimator to estimate the instrumented teacher assessment return to volunteering. The instrumented teacher assessment return (or teacher bias) to volunteering is about an 11 percentile increase.[28]

[26] This point is from personal conversations during fall 2005 with Dr. Sarah Jane Rehnborg, volunteerism consultant for the Points of Light Foundation, AARP, and the Corporation for National and Community Service.

[27] See Keates (September 2, 2005).

[28] I use the same instruments as above in these models also. The hypotheses that the instrumental variables are jointly equal to 0, $H_0 : \theta = 0$, for both reading and math, are strongly reject. The hypotheses that $H_0 : cov(\mathbf{z}, \varepsilon) \neq \mathbf{0}$ tested by the Hansen's J test statistic can not be rejected for both reading and math at the 10 percent level, which is suggestive but not evidence that the instruments are uncorrelated with the error term in the 2nd stage.

Table 3.8: Sensitivity Analysis on the Instrumented Return to Volunteering

Specification	Coefficient on Volunteer Status	
	Reading	
Baseline	6.801	(2.566)
By Gender		
Males	9.210	(3.459)
Females	4.348	(3.672)
By SES quintile		
Bottom	6.106	(6.577)
Second	1.961	(5.729)
Third	1.257	(4.465)
Fourth	1.898	(6.490)
Top	7.115	(4.629)
By Classroom Behavior		
Group misbehaves (very frequently, frequently, occasionally	7.637	(3.091)
Group behaves (well, exceptionally well)	3.803	(4.183)
By Self-Control (Teacher Assessment)		
Poor	4.789	(4.716)
Good	4.569	(3.039)
By Base Scores		
Lower half	2.913	(3.714)
Upper half	7.311	(3.282)

Note: The standard errors are in the parentheses. The full sample size for reading is 6,883 students.

The instrumented return to volunteering is large, but is it too large? The difference between the WLS estimate and the instrumental variable estimates is similar to other studies on education that instrument for endogeneity. Butcher and Case (1994) considered the impact of siblings on the educational attainment of women. They noticed that women that are raised in households with more male siblings also have higher levels of education attainment. Using household sex ratios as a instrument, they found that the return to education with respect to earnings is double that of the non-instrumented estimate. Ashenfelter and Krueger (1994) found an 18 percent return to education after instrumenting for completed education with information on twins. Card (1995) found an instrumented return to education that is twice as large as the non-instrumented estimates by instrumenting for completed education with geographic proximity to a four-year college.[29] Like other studies that instrument for endogeneity, I too find a much larger estimate with the instrumental variable approach.

3.6 Concluding Remarks

The GMM estimate of the return to volunteering is larger than the WLS estimate of the return to volunteering. The instrumented return to volunteering for reading test scores is a 12 percentile increase and the WLS return to volunteering is 2.5 percentile increase. This large difference in the estimates is due to the highly endogenous nature of volunteerism. The magnitude of the difference between estimators is comparable to other studies that use an

[29] In a meta-analysis of the estimates to the return to education, Ashenfelter, Harmon, and Oosterbeek (1999) found that instrumented estimates are typically larger than non-instrumented estimates.

instrumental variables approach.

How do parent volunteers increase test scores? From recent research on education, it is clear that the role unobservables in education production, attainment, and outcome is significant (Ashenfelter, Harmon, and Oosterbeek, 1999; Rivkin, Hanushek, and Kain, 2005). This is no less the case for classroom parent volunteering. Classroom volunteers bring an extraordinary amount of "unobservables" into the education production function that on average positively affects test scores.

An implication of these results is that volunteer and mentor programs are a key element in raising test scores. The stereotype that children of parent volunteers have higher test scores solely because of extra effort spent at home is false. However, the difficulty in exogenously placing volunteers into classrooms is that unobservables may not necessarily accompany a mandated volunteer. Requiring volunteerism might transform volunteering into a paid activity with similarly returns, and an example of such are private school programs that require volunteering in exchange for a tuition reduction.

Parental investment in early education is an important determinant of future earnings of students. Restuccia and Urrutia (2004) found that "one-half of the inter-generational correlation in earnings is accounted for by parent investment in education, in particular early education." As shown here, parent volunteers not only increase the real academic achievement level of their child but also the perceived achievement level. This combined effect in early education years may have a large compounding effect on a child's success in later years.

Chapter 4

Household Bargaining over the Savings Rate

4.1 Introduction

There are a variety of microeconomic models that explain household decisions of consumption and saving. These models incorporate ideas about life-cycle income and wealth, attitudes toward risk, and discount factors.[1] Traditionally, researchers have assumed that household members choose the amount of household savings as a collective body. However, as it has become evident that household members have conflicting preferences, there have been a number of attempts to analyze household savings decisions from the perspective of bargaining models.

We exploit a unique data set from South Korea in which we know both total household savings and also about the distribution of savings over house-

[1] See Browning and Lusardi (1996) for a survey of the literature.

hold members' separate financial accounts. This unique feature of the data set reflects a peculiar institutional framework in South Korea. In South Korea, joint accounts are virtually non-existent; each individual has their own account. Secondly, South Korean law requires that each account be associated with a person's name, thus emphasizes the individuality of financial properties and transactions. Lastly, South Korean divorce law is based on a separate property system. This system guarantees one's right to assets in his or her name in the event of a divorce. These institutional characteristics provide a unique context for analyzing household savings decisions from the perspective of household bargaining.

We find that households where wives have more bargaining power, wives save more in absolute terms, and they also save more in their accounts relative to their husbands. This finding is consistent with the observation that women prefer to save more than men and hence, seek more control over household finances. The unitary household model, where household members combine their incomes and maximize a common utility function, cannot explain our findings.

The remainder of our work is organized as follows: Section 4.2 reviews the related literature, Section 4.3 describes the data set and the institutional framework in South Korea, and Section 4.4 presents a conceptual model and empirical strategy. The results are in Section 4.5, and concluding remarks are in Section 4.6.

4.2 Related Literature

Household members have different preferences over household savings, and they reconcile these differences through a decision-making process. Men and women differ by risk aversion, prudence, self-control, and discount rates; these are all known as standard determinants of household savings. Barber and Odean (2001) show that men are more confident in financial matters than women. Jianakoplos and Bernasek (1998) find that single men are less risk averse than single women in financial decisions. Thomas (1990) finds that women prefer to save more and that unearned income the "hands of a mother" has a larger effect on children than in the hands of the father. Because women on average live longer, women also have a lower discount rate than men. For the various reasons given above, women have a higher propensity to save than men.[2]

It follows from gender differences in preferences that the balance of bargaining power within households affects household saving decisions. Using the gender longevity gap, Browning (2000) shows theoritically that wives save more in households where they have strong decision-making power. In his Nash bargaining model, the husband's savings decreases as the wife's bargaining power increases, but total household savings increases because the wife's savings increases enough to offset the decrease in the husband's savings. Nargis (2003) tests these predictions with the Panel Study of Income Dynamics (PSID). She finds that total household savings increases with the wife's bargaining power, as measured by relative earnings. Similarly, Lundberg and Ward-Batts (2000)

[2] As high private savings rates are an important engine for economic growth, this observation is often cited as evidence that female empowerment fosters economic development in developing countries. For example, East Asian countries save more than 30 percent of gross national disposable income, while African countries save less than 15 percent.

show that wives with stronger bargaining power accumulate more net wealth as they approach retirement. They measure the balance of power by a spouse's relative control over income sources, relative age, and relative education.

Recent studies use information about between-spouse differences in preferences to understand the underlying household savings decision-making process. Mazzocco (2004) approximates spousal differences in attitudes toward risk by using survey questions about lotteries in the Health and Retirement Study. Lich-Tyler (2003) uses subjective questions in the PSID to measure differences in time preferences between spouses. Lich-Tyler finds that bargaining power, measured by the relative education of a spouse's father, determines how differences in preferences are resolved within households.

Other studies use direct questions about the internal decision-making process for financial matters. With the British Household Panel Survey, Dobbelsteen and Kooreman (1997) exploit various questions about family financial organization and decision-makers for financial issues to show that decision-making power in financial management depends on bargaining power. Similarly, for Canadian couples, Woolley (2000) finds that bargaining power determines not only who manages household finances, but whose name is on the household bank account. To our knowledge there is no study, however, about the distribution of household savings over individual accounts.

4.3 Data

The data set we use is from the Korean Household Panel Study (KHPS). Conducted by the Daewoo Research Institute, the KHPS is the first panel survey of South Korean households. It is structured similarly to the PSID,

and the data are available from 1993 until 1998. We exclude households in which the husband is not identified as the head of the household, does not work for pay, or is more than 65 years old. We also exclude households with zero savings and with earners that are neither the husband nor wife.

A unique feature of the data set is that the survey asked about total household savings *and* the distribution of household savings over individual accounts. Beginning in 1995, the survey asked about individual holdings of bank and financial assets. In 1995, the question about individual holdings was, "How much did you save monthly in bank accounts on average in 1994?" In 1996, respondents were asked about their accumulated stock of financial assets.[3] In 1997, the survey emphasized savings in individual accounts by explicitly asking, "How much did you save monthly under *your name* on average in last year?" We use the 1997 data because of the emphasis on individual accounts. The sample size for this year is 1,041 couples.[4]

Another unique feature of the data set is the peculiar institutional framework of South Korea. The use of joint accounts is rare in South Korea. The reason for the absence of joint accounts is not well known; only recently have some banks begun to offer joint spousal accounts.[5] A real-name financial

[3] The same question in 1995 asked about flows of financial assets.

[4] We do not use observations for 1998 because that year several major commercial banks declared bankruptcy due to the Asian financial crisis.

[5] We found no definitive statistic regarding the absence of joint accounts. We did, however, visit with an accounting professor at a South Korean university, a senior researcher at the South Korean central bank, and a former employee at a national bank in South Korea about the absence of joint accounts. Each confirmed that financial accounts with joint legal status do not exist in South Korea. Moreover, joint accounts are becoming less popular in developed countries. The proportion of married women in the U.S. who keep checking or savings accounts in their own names is increasing (Treas, 1993). A survey on joint accounts conducted by the Abbey National Bank of the United Kingdom finds that women are more reluctant than men to have a joint account ("Women More Reluctant to Have Joint Bank Account," Press Association, June 10, 2003). Reasons for not wanting a joint account include: uncertainty in the relationship (57%), to avoid arguments (48%), and lack of trust

transaction law, legislated in 1993, requires that any financial account must be registered under a person's real name. This law also prohibits the accessibility to one's financial assets by others, even if they are family members.[6] In this institutional framework, with no joint accounts and limited access to others' accounts, couples must decide on whose account to deposit household savings.

Descriptive statistics about these data are presented in Table 4.1. Earnings and savings are denominated in 10,000 South Korean won and for an average month. During this time period, 10,000 won was roughly equivalent to about 10 United States dollars. For all households, the average monthly earnings for husbands is about 8 times larger than wives' average monthly earnings. After removing wives who do not work for pay (see Column Full-time workers), the average month earnings for husbands is about 2 time larger than wives' average monthly earnings.

The savings rate is defined as the ratio of savings to earnings. The average household savings rate is about 30 percent; this is similar to the national savings rate published by the South Korean national statistics bureau. We cannot use disposable income since information on tax payments and all sources of non-labor income is not available. Most households save more in the husband's bank account than in the wife's bank account. The average holdings for husbands is about 35 percent larger than their wives. For two-earner households, there is no savings gap. About 40 percent of wives do not have an account. It is also notable that in single-earner households wives save more

that their partner or spouse will use the money sensibly (27%). The Bank reports that 30 percent of couples in the UK have a joint account.

[6] Civic organizations and women's rights advocates are critical about the restricted access to family members' accounts. They argue that the law should allow one to inquire about his or her partner's accounts to prevent the partner from hiding marital assets in the event of a divorce.

Table 4.1: Descriptive Statistics[1]

	All households		Full-time workers	
	Husbands	Wives	Husbands	Wives
Individual savings	38.0	28.2	40.5	41.4
	(41.6)	(41.9)	(44.8)	(52.1)
Household savings	66.1		81.9	
	(54.0)		(61.9)	
Wife's share of savings (%)	40.8		49.3	
	(41.2)		(39.4)	
Individual earnings	201	25.7	175	86.5
	(91.9)	(50.5)	(81.5)	(63.7)
Household earnings	226		261	
	(102)		(119)	
Wife's share of earnings (%)	9.7		32.2	
	(16.8)		(15.9)	
Age	39.9	36.6	40.7	37.2
	(7.4)	(7.0)	(7.5)	(6.9)
Education (years of schooling)	12.6	11.6	12.3	11.2
	(2.8)	(2.6)	(2.8)	(2.6)
Number of children	1.8		1.8	
	(0.7)		(0.9)	
Metropolitan residence	0.6		0.6	
	(0.5)		(0.5)	
Spearman correlation	-0.4		-0.4	
	$[p < 0.01]$		$[p < 0.01]$	
$N =$	$1,041$		213	

[1] Standard deviations are in parentheses. Earnings and savings are in terms of 10,000 South Korean won. Spearman correlation is the test statistic of testing for the independence between spouses' savings.

than what they earn. This suggests that part of the husband's earnings are transferred to the wife's bank account. There is a positive correlation between savings and the distribution of income between spouses.

In the event of a divorce, the separate property system gives individuals ownership of accounts in their name. Property which is obtained before marriage or obtained under a specific name during marriage belongs to that individual (Korean Civil Law, Article 830, Clause 1).[7] Although the spouse may request that the assets be divided (Korean Civil Law, Article 839, Clause 2), researchers find that when a judge further divides the assets that the wife's contribution to household wealth is underestimated if she does not work for pay (Lee, 1990; Won, 1992; Cho and Chun, 2004). Furthermore, the law cannot prevent husbands from disposing or holding back household property under their name before a divorce (Cho and Chun, 2004). The South Korean legal environment is an important reason why the division of household savings over individual accounts is a function of household bargaining.

4.4 Empirical Strategy

4.4.1 Conceptual Model

The unitary household model assumes that individual members pool their incomes and maximizes a single utility function. For simplicity, consider a two-period model of consumption and savings. According to the unitary model,

[7] In other words, property accumulated after marriage, and held under an individual's name, is the property of that individual.

each household maximizes the following utility function:

$$V(c_1^h, c_1^w) + \delta V(c_2^h, c_2^w), \tag{4.1}$$

where δ is a household discount factor, V is the household utility function, and c_t^j is consumption of spouse j at time t. For periods 1 and 2, the binding budget constraints are respectively:

$$\begin{aligned} c_1^h + c_1^w + (s^h + s^w) &= y_1^h + y_1^w \\ c_2^h + c_2^w &= r(s^h + s^w) + y_1^h + y_1^w, \end{aligned} \tag{4.2}$$

where y_t^j is the earnings of spouse j at time t, r is the gross interest rate, and s^j is the savings in the account of that spouse. In the unitary model, only the sum of individual savings is chosen. Total savings depends on household income, the gross interest rate, and preferences including the discount factor. Secondly, only the sum of individual earnings matters in determining total savings. This is also known as the income-pooling hypothesis.

Now consider a simple household bargaining model where each spouse has a potentially different set of preferences. Define individual utility as $u(c_t^j)$. The utility function is egoistic in that it depends on the individual's own consumption. In each period spouses divide total income into consumption and savings. We assume that spouses can divorce each other in the second period with probability p. In the event of a divorce each spouse keeps what is in his or her own account. Otherwise, total savings are divided between spouses. We assume that a household decision is on the ex-ante Pareto frontier (Mazzocco, 2004). From this it follows that we can represent the household's

optimization problem in the first period as:

$$\mu[u^w(c_1^w) + \delta^w(p \cdot u^w(c_2^{wD}) + (1-p) \cdot u^w(c_2^{wM}))] + \tag{4.3}$$
$$(1-\mu)[u^h(c_1^h) + \delta^h(p \cdot u^h(c_2^{hD}) + (1-p) \cdot u^h(c_2^{hM}))],$$

where μ denotes the wife's relative bargaining power, $0 < \mu < 1$, c_2^{jD} is the consumption of spouse j if he divorces in the second period and c_2^{jM} is the consumption of spouse j if he remains married in the second period.[8] If a couples divorces, then each consumes his own income and savings, $c^{jD} = y_2^j + rs^j$.

Households choose not only total savings, but also the distribution of savings over individual accounts, and consumption. Let s denote total savings and θ denote the wife's relative share of savings, s^w/s. Assuming an interior solution, the first-order condition for θ is:

$$\frac{\mu\delta^w}{(1-\mu)\delta^h} = \frac{u^{h\prime}(y_2^h + (1-\theta)rs)}{u^{w\prime}(y_2^w + \theta rs)}. \tag{4.4}$$

This solution shows that if there is a positive probability of divorce, spouses save more in their own accounts. How successful spouses are at saving in their own account depends on the balance of bargaining power.[9] As μ increases in equation 4.4, conditional on s, θ increases, and vice versa.[10] Unlike the

[8] We exclude the case of $\mu = 0$ or $\mu = 1$ in which the bargaining model simplifies into the unitary model.

[9] If we allow for divorce in the unitary model, then we need a decision-making process for the division of savings, and thus the model is no longer a model of a unitary household.

[10] If μ also affects total savings, then the effect of μ on θ is ambiguous. The sign depends on $ds/d\mu$ and $\mu\theta\delta^w u^{w\prime\prime}(c_2^{wD}) - (1-\mu)(1-\theta)\delta^h u^{h\prime\prime}(c_2^{hD})$. However, if μ increases total savings and μ and θ are relatively small the effect is likely to be positive. These assumptions are reasonable because women are willing to save more and in South Korea a wife has little bargaining power.

unitary model, total savings depends on the balance of power because spouses have different preferences. For example, if the wife has a low discount rate, she prefers to save more. Note that this prediction holds even if there is no possibility of divorce.

In the above model, bargaining power is given exogenously. However, individual savings also affects bargaining power. Cartwright, Khandker, and Pitt (2003) find that a wife's financial autonomy increases her bargaining power over household expenditures. Spouses can use savings in their own accounts for private consumption without being monitored by their partners. Anderson and Baland (2002) show that wives use financial control to protect household resources from their husbands' squanderings. If individual savings affects bargaining power then spouses prefer to save more in their accounts, *ceteris paribus*. This prediction also holds if there is no possibility of divorce.

Another factor that affects the division of savings even in the context of the unitary model, which the above models do not account for, is transaction costs. For example, when only one spouse works for pay, the other spouse may specialize in domestic tasks including the management of household finances. It is more efficient to open a bank account in the name of the spouse who is responsible for financial management than in the name of the spouse who works for pay (Treas, 1993). In doing so, couples minimize transaction costs by increasing the financial manager's access to household resources. Dobbelsteen and Kooreman (1997) call this the household production model of financial management.

4.4.2 Estimation

To test the unitary and the bargaining household model, we estimate a system of simultaneous equations for total household savings and its division over individual accounts:

$$s_i = \alpha_0 + \alpha_1 \mu_i + \alpha_2 y_i + \mathbf{X}_i' \alpha_3 + u_i \tag{4.5}$$

$$\theta_i = \beta_0 + \beta_1 \mu_i + \beta_2 y_i + \mathbf{X}_i' \beta_3 + v_i \tag{4.6}$$

where subscript i represents a household, y_i is total earnings, $s_i = s_i^h + s_i^w$ and $\theta_i = s_i^w/(s_i^h + s_i^w)$. A vector of individual and household characteristics, $\mathbf{X}_i$, includes spouses' age and education, the number of children, and an indicator for urban residence. The variable μ_i is a proxy of the wife's relative bargaining power. We jointly estimate these equations by the seemingly unrelated regression method, which allows the error terms, u_i and v_i, to be arbitrarily correlated. The unitary model states that bargaining power does not affect savings or the share of savings: $\alpha_1 = \beta_1 = 0$.

The effect of μ_i on θ_i, however, is valid only after conditioning θ on total savings, s_i. To include this assumption we consider a two-stage decision-making procedure in which households decide total savings and then, conditional on total savings, allocate total savings over individual accounts. We estimate this decision by two-stage least squares. This is given by:

$$s_i = \alpha_0 + \alpha_1 \mu_i + \mathbf{W}_i' \alpha_2 + \mathbf{Z}_i' \alpha_3 + u_i \tag{4.7}$$

$$\theta_i = \beta_0 + \beta_1 s_i + \beta_2 \mu_i + \mathbf{W}_i' \beta_3 + v_i, \tag{4.8}$$

where $\mathbf{W}_i$ is a set of control variables and $\mathbf{Z}_i$ is a set of instruments for s_i that

affects total savings but does not affect the wife's share of savings.

A difficulty in estimating the above is finding a suitable proxy for bargaining power. First, we use the ratio of the wife's earnings to total household earnings, $\mu_i = y_i^w/(y_i^h + y_i^w)$. Relative earnings are a measure of bargaining power since they measure one's contribution to household resources.[11] A woman's access to employment outside the home also increases her domestic decision-making power. Basu (2007) argues that a wife's bargaining power should come from what she actually earns as well as her wage rate. A wife's labor supply, however, also affects the threat point because female career interruptions during marriage diminish human capital and job opportunities after divorce.

Critics of relative spousal earnings as a measure of bargaining power note that a spouse's labor income is the product of the wage rate and hours worked. If consumption and leisure are not separable in preferences then the coefficient on μ_i captures the direct effect of labor supply and leisure on consumption, and thereby also on savings (Lundberg and Pollak, 1996). For example, when a wife works for pay in the labor market, her shadow price of working at home increases. As a result, *ceteris paribus* consumption is higher and savings is lower. This correlation of preferences confounds the effects of bargaining power. Another criticism of relative earnings is that they do not acknowledge the value of home production. Pollak (2005) points out that earnings within a marriage are not a good proxy for potential earnings outside a marriage because labor supply is endogenous to household production.

To address the problem of endogenous labor supply, we follow the lit-

[11] For papers that use relative earnings as a proxy for bargaining power see Phipps and Burton (1992), Hoddinott and Haddad (1995), Browning et al. (1998), Lundberg and Ward-Batts (2000), Woolley (2000), and Nargis (2003).

erature and restrict the sample to households in which both spouses work 35 hours or longer (Bourguignon and Chiappori, 1992; Browning, Bourguignon, Chiappori, and Lechene, 1994). This mitigates the substitution effect between consumption and labor supply. Married women's labor force participation in the full sample is quite low, thus restricting the sample to only households where both spouses work may significantly lessens the endogeneity of relative earnings.

We also use non-labor income from non-bank financial assets as an alternative proxy for bargaining power. In 1996, the KHPS asked individuals about their holdings of various financial assets other than savings, such as insurance, equity, bonds, and private loans. In 1997, however, there is no information about spouses' non-labor income. We use the wife's relative holdings of non-bank financial assets in 1996 as a measure of bargaining power. This measure may be a better proxy of bargaining power than relative earnings because we better avoid the endogeneity of recent labor supply (Thomas, 1990). Non-labor income is still not completely free from the endogeneity problem of labor supply because non-labor income is an accumulation of past earnings and savings decisions (Lundberg and Pollak, 2003).

4.5 Results

Table 4.2 presents the results when we use the wife's relative earnings as an indicator for her relative bargaining power (see equations 4.7 and 4.8). We find that as the wife's relative earnings increases, total household savings increases. A standard-deviation increase in the wife's relative earnings increases household savings by about 9 percent. The effect of relative earnings on the wife's

share of savings is also significant. A standard-deviation increase in the wife's relative earnings increases her share of savings by 17 percent. As expected, an increase in total earnings increases household savings. Holding the wife's relative earnings constant, a 10 percent increase in total earnings increases total savings by about 3 percent. The wife's relative earnings might be correlated with higher-order terms of total earnings and the savings rate might change over income levels. To allow for these possibilities, we include the square of total earnings. This higher-order term, however, is not statistically significant. The last two columns in Table 4.2 present the results for full-time workers. As before, the wife's relative earnings increases both total savings and her relative share of savings. A standard-deviation increase in the wife's relative earnings increases household savings by 16 percent and the wife's share by about 22 percent. Decisions about household savings are more sensitive to spouse relative earnings when both spouses are full-time workers.[12] In Table 4.3 we use non-labor income as an alternative measure of bargaining power. We use the spousal difference rather than the ratio because many couples do not have financial assets other than bank savings. In addition, we include the total amount of financial assets and accumulated individual savings for each spouse in the previous year to control for heterogeneity in preferences. An increase in the wife's relative non-labor income increases her share of savings but it does not affect total savings. Along with non-labor income, we also include the wife's relative earnings and obtain similar results. The unitary model does not explain these results. Even if relative earnings do not represent bargaining power, the unitary model predicts that individual earnings do not influence

[12] Tax incentives to smooth holdings over individual bank accounts for two-earner couples do not exist during this period. Income taxes were levied on the sum of spouses' earnings.

household decisions, controlling for total earnings and the endogeneity of labor supply. These data show, however, that individual earnings do not affect the household decision over savings. Table 4.4 shows results from the two-stage least squares estimation (see equations 8 and 9). Based on our findings in Table 4.2, we use total earnings, total earnings squared, and number of children as instruments for total savings. The Anderson test shows that these instrumental variables are relevant, and the Sargan test shows that they are valid.[13] The wife's relative earnings increases both total savings and the wife's relative share of savings. We find, however, that total savings does not directly affect the wife's share of savings.

[13]The Sargan test is a test of overidentifying restrictions. The null hypothesis is that the instruments are uncorrelated with the error term in the first stage. The test statistic is distrbuted chi-squared in the number of overidentifying restrictions.

Table 4.2: Relative Earningstics[1]

	All households		Full-time workers	
	Total savings	Wife's share	Total savings	Wife's share
Wife's relative earnings	0.220	0.419	0.399	0.565
	(0.079)	(0.079)	(0.212)	(0.169)
Total earnings	0.269	0.012	0.204	-0.112
	(0.037)	(0.037)	(0.101)	(0.080)
Total earnings squared/100	0.004	-0.003	0.009	0.012
	(0.005)	(0.005)	(0.013)	(0.010)
Husband's age	0.822	-0.897	3.229	-0.335
	(0.463)	(0.463)	(1.271)	(1.011)
Wife's age	-1.122	0.723	-3.564	0.264
	(0.488)	(0.488)	(1.341)	(1.067)
Husband's education	-0.338	-0.054	1.179	-0.675
	(0.627)	(0.627)	(1.762)	(1.402)
Wife's education	0.183	0.119	1.255	0.330
	(0.738)	(0.739)	(2.022)	(1.609)
Number of children	-3.940	-0.087	-5.787	0.823
	(1.716)	(1.717)	(4.294)	(3.416)
Metropolitan residence	-0.962	1.327	1.439	-0.163
	(2.581)	(2.582)	(6.717)	(5.344)
Constant	17.238	44.095	-9.769	57.513
	(13.196)	(13.203)	(39.147)	(31.142)
R^2 =	0.377	0.032	0.400	0.063
Breusch-Pagan test of independence	$\chi^2(1) = 1.63$		$\chi^2(1) = 0.82$	
p-value	0.20		0.36	
Number of observations	1,041	1,041	213	213

[1] Standard errors are in parentheses.

Table 4.3: Non-labor Income[1]

	Total savings	Wife's share	Total savings	Wife's share
Wife's relative earnings			0.190	0.388
			(0.089)	(0.089)
Husband's relative nonlabor income (proxy)	0.011	0.049	0.002	0.033
	(0.017)	(0.019)	(0.018)	(0.019)
Total nonlabor income (proxy)	0.065	0.013	0.056	-0.004
	(0.018)	(0.019)	(0.019)	(0.019)
Stock of individual savings	0.028	0.086	0.029	0.068
	(0.010)	(0.046)	(0.010)	(0.046)
Total earnings	0.247	0.023	0.234	-0.003
	(0.039)	(0.039)	(0.039)	(0.039)
Total earnings squared	0.005	-0.005	0.006	-0.002
	(0.005)	(0.005)	(0.005)	(0.005)
Husband's age	0.803	-0.814	0.767	-0.886
	(0.486)	(0.489)	(0.485)	(0.485)
Wife's age	-1.152	0.687	-1.159	0.676
	(0.515)	(0.518)	(0.513)	(0.513)
Husband's education	-0.631	0.010	-0.524	0.237
	(0.661)	(0.665)	(0.661)	(0.660)
Wife's education	0.329	-0.123	0.352	-0.064
	(0.777)	(0.783)	(0.775)	(0.776)
Number of children	-2.322	-1.025	-2.579	-1.556
	(2.163)	(2.178)	(2.162)	(2.160)
Metropolitan residence	0.127	0.504	0.165	0.554
	(2.730)	(2.751)	(2.724)	(2.724)
Constant	19.002	49.907	20.158	51.959
	(14.888)	(14.986)	(14.862)	(14.845)
R^2 =	0.371	0.023	0.374	0.042
Number of observations	937	937	937	937

[1] Standard errors are in parentheses. Information on financial assets in 1996 is missing for 104 couples. Some of them are newly surveyed in 1997.

Table 4.4: Two-Stage Least Squares Estimation[1]

	All households		Full-time workers	
	Total savings	Wife's share	Total savings	Wife's share
Total savings		-0.035		-0.067
		(0.045)		(0.090)
Wife's relative earnings	0.220	0.431	0.399	0.584
	(0.079)	(0.082)	(0.217)	(0.178)
Husband's age	0.822	-0.894	3.229	0.046
	(0.465)	(0.464)	(1.302)	(1.055)
Wife's age	-1.122	0.701	-3.564	-0.022
	(0.491)	(0.491)	(1.374)	(1.135)
Husband's education	-0.338	-0.045	1.179	-0.901
	(0.630)	(0.625)	(1.805)	(1.408)
Wife's education	0.183	0.144	1.255	0.675
	(0.742)	(0.741)	(2.071)	(1.637)
Metropolitan residence	-0.962	1.343	1.439	-0.176
	(2.593)	(2.575)	(6.881)	(5.426)
Total earnings	0.269		0.204	
	(0.037)		(0.104)	
Total earnings squared/100	0.004		0.009	
	(0.005)		(0.013)	
Number of children	-3.940		-5.787	
	(1.725)		(4.399)	
Constant	17.238	47.036	-9.769	38.491
	(13.260)	(12.261)	(40.100)	(27.912)
R^2 =	0.377	0.028	0.400	0.063
Anderson's test for IV relevance	$p < 0.01$		$p < 0.01$	
Sargan test	$p = 0.83$		$p = 0.46$	

[1] Standard errors are in parentheses.

4.6 Summary

The recent development of household bargaining models focuses on collective labor supply and household consumption. Our paper extends the scope of bargaining models to household savings over individual accounts. Exploiting a unique data set from and institutional framework in South Korea, we analyze the determinants of household savings at the spouse level. Our findings indicate that the balance of power between spouses plays a significant role in determining the intra-household distribution of savings as well as the overall level of household savings. These results also support previous findings that women have a higher propensity to save than men. These results extend to countries other than South Korea. In spite of strong traditional gender roles in South Korea that might discourage joint household decisions, we find strong evidence that household savings is decided through a bargaining framework. Given these constraints on acceptable behaviors, couples in less rigid societies are likely to have a higher incidence of household bargaining over financial resource allocation than households in South Korea.

Chapter 5

Conclusion

For centuries, households have been the fundamental unit of society. In the above chapters, I have discussed and presented evidence on their allocation of time and goods, the productivity of donations of household time, and the process by which they come to a consensus on household decisions. As good research becomes the foundation for future work and ideas, hopefully the ideas in these chapters will leads others to the next question, the next paper, and the next contribution to society.

In summary, in the second chapter I found that the time and goods cost of a child is large – much larger than the goods cost only. With the wage as the price of leisure and the price of child care at 1/3 of the market cost for child care, the quarterly cost of a child for a single mother is $7,000. This is seven times the cost of a child calculated with only household expenditures on goods. Time rather than goods is the larger cost of raising children.

In Chapter 3, The Return to Donations of Time, I found that the instrumented return to volunteering for reading test scores is a 12 percentile increase and the non-instrumented return to volunteering is 2.5 percentile in-

crease. This large difference in the estimates is simply because volunteering is a very endogenous activity. Parent volunteers not only increase the real academic achievement level of their child but also the perceived achievement level as measured by subjective teacher assessments. The impact of volunteer and mentor programs is more than an urban legend.

In the final chapter, my coauthor and I found that the balance of power between spouses plays a significant role in determining the intra-household distribution of savings as well as the overall level of household savings. These results support previous findings that women have a higher propensity to save than men.

Appendix A

A.1 Cost of Children on the Construction of Price Levels

A.1.1 Geographical Information for Respondents in the CPI, ATUS, and CEX

1. CPI: For roughly each good in the CPI, the BLS publishes monthly area indices for the US: four regions (Northeast, Midwest, (formerly North Central), South, and West), three population size-classes (A, B/C, and D) and ten region-by-size groups (Northeast-Size Class A, South-Size Class D, etc.). The A population size class represents all metropolitan areas over 1.5 million people, B/C represents mid-sized and small metropolitan areas (fewer than 1.5 million), and D represents all non-metropolitan urban areas. Due to insufficient sample sizes, region-by-size indices are not published for Northeast and West Size Class D. In addition, the BLS publishes CPI information for 26 metropolitan areas monthly, bimonthly, or semi-annually. Some of these metropolitan areas,

as defined by the Bureau of the Census, include suburbs or counties that extend across state boundaries.

2. ATUS: For each respondent, the ATUS has the following information about their residence: metropolitan status, region, and state. Though the ATUS sample is from the out-going rotation of the CPS, more detailed geographical information is not available. Specifically, the following variables, though available in the CPS, are not available in the ATUS: CMSA FIPS code, MSA/PSMA code, County code, Central City/Balance Status, Individual Central City, MSA/PMSA Size, and CMSA/MSA Size. Matching individuals from the ATUS to the original CPS (and not the CPS files packaged with the ATUS data set) to get more geographical information is possible, however, to get more detailed information on a respondent's residence.

3. CES: For each respondent, the CES has the following information about their residence: metropolitan status, region, state, population size (5 categories), and urban/rural. The CPI has information by three types of city size, four regions, regions by city size, and select metropolitan cities. A metropolitan city is defined by the Office of Management and Budget. These cities are called MSAs or Metropolitan Statistical Areas. Size class A and B/C are MSAs with populations large than 1,500,000 people and between 50,000 and 1,500,000, respectively. Size class D are non-MSA cities and population areas under 50,000.

A.1.2 Consumer Price Index

Prices, or price indices when prices are not available, are critical pieces of information to estimate a demand system. Commonly used prices indices from the Bureau of Labor Statistics (BLS) describe price variation across time within areas (Bureau of Labor Statistics, 2004a, pg. 6). If prices are too similar or do not vary, then the Hessian can not be inverted and demand estimates can not be obtained. Because I use only one year of the CEX, these indices do not have enough variation to estimate a demand system. In order to have more price variation, I construct indices that are comparable across areas and time by using the price levels constructed by Kokoski, Cardiff, and Moulton (1994) and the CPI price indices from 1989 to 2003.

Since 1913 BLS produced price indices have been available for various goods and regions.[1] To create the index, BLS agents first collect price information on goods throughout the county. In addition to price information, agents also collect large amounts of information about the product such as: size, quality, brand name, and packaging of the good. The BLS decides what goods to sample from the Consumer Expenditure Survey, which is a snapshot of what consumer units are purchasing. With these weights, the BLS creates price indices for 95 percent of the items that consumers purchase. The constructed price index from these data on goods prices is comparable only within areas. For example, suppose in 2001 that the price index for bread in Austin, Texas is 125 and that the price index for bread in Fairfax, Virginia is 120. In the following year suppose that the indices increase by 10 points in

[1] See Kokoski (1991) and Bureau of Labor Statistics (2004a, pg. 7) for a brief history of BLS and interarea price indices, and overview of approach to creating interarea indices from intertemporal price indices.

Austin and by 15 points in Fairfax. The price of bread in Austin increased by 8% $\left(\frac{135-125}{125} * 100\right)$ and the price of bread in Fairfax increased by 12.5% $\left(\frac{135-120}{120} * 100\right)$. It is a true statement that the price of bread rose faster in Fairfax than in Austin, however, because of how these indices are constructed, it is not true that bread in Fairfax is the same price as bread in Austin– although the indices are the same. To begin to make the later statement, we need information on price levels. These price indices only give information on the rates of change. In addition to not being able to compare indices across areas, it is also not possible to compare goods within an area.

Kokoski, Cardiff, and Moulton (1994) create area comparable price indices for June 1987-June 1988 from information available to the Bureau of Labor Statistics (BLS). The BLS has price, quality, and quantity information for the goods that are components of each of the indices it creates. To mitigate these product difference across areas, Kokoski et al. use a linear projection of the price of the good on characteristics of the goods and areas.[2] The coefficients on the area covariates identify price differences by area. With estimates from those regressions, and some normalizations, they construct a price index that is comparable across areas for June 1987-June 1988. This regression methodology is known as the County-Product-Dummy regression. Summers (1973) proposed this method to compare different baskets of goods across countries.

Kokoski et al. provide a wealth of information from the BLS database, via estimates from County-Product-Dummy regressions. They report inter-area comparable price levels for aggregate good groups as well as some select

[2]See also Kokoski, Moulton, and Zieschang (1996).

subgroups.[3] For each good group, price levels are available for the defined CPI areas in 1988/89. The price levels they report cover 75% of household expenditures.

To construct 2003 price levels, I scale the 1988/89 price levels, provided by Kokoski et al., by the change in prices from 1988/89 to 2003 as reported in the CPI.[4] Due to changes in demographics, available products, and consumer purchasing bundles, the BLS made numerous changes in the BLS/CPI definitions of areas and goods. Many of the area definitions in 1988/89 are aggregated in the 2003 definitions as adjacent cities grow into one larger city. Similarly, in 2003, many more goods are available to the household than in 1988/89. New goods and areas in 2003 are linked to similar goods and areas in 1988/89. For both new goods and new area definitions, the variation in price comes mostly from inflation rather than from differences in price levels.[5]

The scaling of 1988/89 to 2003 prices indices is:

$$pricelevel_{ij2003} = \left(price\ index_{ij2003} - price\ index_{ij1988/89}\right) pricelevel_{ij1988/89} \tag{A.1}$$

where i is a good and j is a area. Note that i and j may be different in 2003 and in 1988/89 because of changes in the item and area definitions. Because of new good definitions and the discontinuance of other goods, a price index series may not exist from 1988 to 2003. In this case, I piece together changes

[3]The major good groups that I use are: alcohol, enterainment, men's apparel, boy's apparel, women's apparel, girl's apparel, infant's apparel, footwear, rent (for rentors and owner's equivalent), professional medical services, household furnishings, food at home, and food away, utilities, private transportation. For more detail on the definition of these groups, see the BLS/CPI good definitions for 1988/89.

[4]I use the CPI-U index not adjusted for seasonality.

[5]Hobijn and Lagakos (2003) use a similar mapping of goods into recent good definitions. The authors, however, look only at national price indices and hence do not map area definitions.

in prices first from similar areas, and then second from similar goods.[6]

Price Merging

Matching goods I match the goods in the CPI with the goods in the CEX. Because the construction of the CPI is based on weights obtained from the CEX, many goods are similarly defined.

Matching areas The ATUS, CEX, and CPI each have different amounts of information about respondents' place of residence. All data sets identify metropolitan status and state of residence of the respondent, unless censored for confidentiality reasons. Thus, for each combination of metropolitan status and state I construct weighted price levels by the population density of each state.

From the Census Bureau I gather the July 1999 population densities for each state: metropolitan, non-metropolitan, MSA, CMSA, and PMSA. All of the MSAs defined in the 2003 CPI are similarly defined in the 1999 Census except for Boston-Brockton-Nashua which is defined in the Census as Boston-Worcester-Lawrence. I assume that these areas are roughly the same. An MSA in the CPI may cross multiple states. I separate these MSAs, one for each state. Similarly, the Census divides the population of MSAs that are in multiple states into the amount that falls into each state.

From the Census Bureau I have information on all MSAs in a state, the percent of the state's population in each MSA, and the percent of the population not in the MSA. To create prices indices by state and metropolitan

[6] About half of the areas defined in 1988 are similarly defined in 2003. The majority of the goods defined in 1988, however, are similarly defined in 2003.

status I use

$$price_{i,s,metro} = \frac{A * a + B * b + MSA_1 * msa_1 + MSA_2 * msa_2 + MSA_3 * msa_3}{a + b + msa_1 + msa_2 + msa_3} \tag{A.2}$$

$$price_{i,s,non-metro} = \frac{D * d}{d} = D \tag{A.3}$$

where i is a good, s is a state, A, B, and D are size prices, a, b, and d are the percentage of the population that live in those areas, respectively. If an MSA has no corresponding CPI information, and it is larger than 1.25 million people, then it is included in a, otherwise metropolitan areas are included in b.[7] If information on an MSA is available, then the related population is removed from either a or b as appropriate. Non-metropolitan populations of the state are placed in d. If a region does not have a size D, I use the next larger size. No state has more than three MSAs reported in the CPI.

When necessary to maintain confidentiality, information on the state of residence is missing in the CEX. When this is the case, I use region of residence instead. The price index I use for these cases is

$$price_{i,s,metro} = \frac{A * a + B * b}{a + b} \tag{A.4}$$

$$price_{i,s,non-metro} = \frac{D * d}{d} = D \tag{A.5}$$

where a and b are the percent of the population that lives in Metropolitan Inside Central City and Metropolitan Outside Central City respectively. The non-metro price are those who live in Non-metropolitan areas.

[7] The 2003 CPI defines Size A and B as metropolitan areas. Size As are population areas greater than 1.5 million people. Size Bs are population areas less than 1.5 million people. To make 2003 population sizes relative to 1999 populations I assume a population growth rate of about 4 1/2%, which backs out from a 1999 population size of 1.25 million people.

A.2 Volunteering

A.2.1 Questions About Volunteering in the First Grade

Teacher Questionnaire A

- How often do children in your class who need more help with reading receive the following kinds of services while at school? (Never, Less than once a week, Once or twice a week, 3 or 4 times a week, Daily; Minutes per session.)
  - Individual tutoring from an aide or volunteer
- In a typical week, about how many total hours do volunteer(s) assist with your class? *If there are two or more volunteers please add up their weekly totals.* (Total number of hours per week.)
- How many hours a week do volunteers usually assist in your class in the following ways?
  - Working directly with children on instructional tasks
  - Doing noninstructional work (e.g., photocopying, preparing materials, etc.)
- What percent of children in your class have parents who participate in the following activities? (None, 1-25%, 26-50%, 51-75%, 76-100%)
  - Volunteer regularly to help in your classroom or another part of the school

Teacher Questionnaire C

- During this school year, have this child's parents/guardians participated in the following activities? (Yes, No, Not Applicable/Not Offered)
  - Volunteered to help in your classroom or school

Parent Questionnaire

- Since the beginning of this school year have you or the other adults in your household ... Volunteered at the school or served on a committee? (Attended? Who did this? (i.e. mom, dad, step-mom, etc.))

School Administrator Questionnaire

- What percent of children in the school have parents who participate in the following activities? (None, 1-25%, 26-50%, 51-75% ,76-100%)
  - Volunteer regularly to help in the classroom or another part of the school

Full Set of Control Variables

- School Conference with Parent, Send Home Things to Parent, and Share Portfolio with Parents
- Class Minority, Number of Paid Aides, Total Class Enrollment, and Ratio of Girls to Boys, and Ratio of New to Total Students
- Student Participates in School-based Title 1 Math Program, Individual Tutoring Math Program, and Small Pull-Out Math Group

- Teacher Non-White, and Number of Years Teaching at this School and Years as School Teacher
- Teacher and Teaching Aide's Education Certifications
- Teacher hours of paid and unpaid preparation time
- Interval between assessments (days), spring (1st) - spring (K)
- Family composition and Mother's age
- Number of siblings, Sibling squared, and Sibling cubed
- Number of times parent tells story to child, reads book to child, and spanked child last week
- Mother and father's work hours and employment status
- Mother and father's level of education
- Socio-economic status measure
- Classroom average mother and father's level of education
- Classroom average mother and father's occupation score
- Classroom average socio-economic status measure
- Outside of school activities
- Child reads to self outside of school and uses computer for education purposes outside of school
- Parent has library card, Child has library card

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